

04-03-00

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03/30/00
JC784 U.S. PTO

PATENT
Docket No. SHAU-2K01

Box Patent Application
Commissioner of Patents and Trademarks
Washington, D.C. 20231

JC678 U.S. PTO
09/539309
03/30/00

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of
Inventor(s): **Jeng-Jye Shau**

WARNING: Patent must be applied for in the name(s) of all the actual inventor(s). 37 CFR 1.41(a) and 1.53(b).

For (title): **DATA TRANSFER USING TELEVISION VIDEO SIGNAL**

1. Type of Application

This new application is a(n) (check one applicable item below):

- ☒ Original
- ☐ Design
- ☐ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4) unless the International Application is being filed as a divisional, continuation or continuation-in part Application.

NOTE: If one of the following 3 items apply then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED.

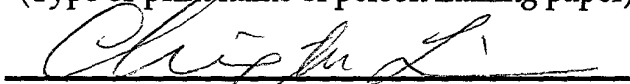
- ☐ Divisional
- ☐ Continuation
- ☐ Continuation-in-part (CIP)

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date March 30, 2000 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EK475093378US addressed to the :
Assistant Commissioner for Patents, Washington, D.C. 20231.

Ching-lu Lin

(Type or print name of person mailing paper)



(Signature of person mailing paper)

NOTE: Each paper or fee referred to as enclosed herein has the number of the "Express Mail" mailing label placed thereon to mailing. 37 CFR 1.10(b).

2. Benefit of Prior U.S. Application(s) (35 USC 120)

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

- ☐ The new application being transmitted claims the benefit of prior U.S. application(s) and enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed Which Are Required For Filing Date Under 37 CFR 1.53(b) (Regular) or CFR 1.153 (Design) Application

- 28 Pages of specification
- 12 Pages of claims
- 1 Pages of Abstract
- 16 Pages of Drawings
- ☒ formal
- ☐ informal

WARNING: DO NOT submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted the Office. Only one copy is required or desired. Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 O.G. 57-62).

NOTE: "Identify indicia such as the serial number, group and unit, title of the invention, attorney's docket number, inventor's name, number of sheets, etc., not to exceed 2 3/4 inches (7.0 cm.) in which may be placed in a centered location between the side edges within three fourths inch (19.1 mm.) of the top edge. Either this marking technique on the front of the drawing is acceptable." Proposed 37 CFR 1.84 (1). Notice of March 9, 1988 (1090 O.G. 57-62)

4. Additional papers enclosed

- ☐ Preliminary amendment
- ☐ Information Disclosure Statement
- ☐ Form PTO-1449
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath

☒ Enclosed

executed by (check *all* applicable boxes)

☒ inventor(s).

☐ legal representative of inventor(s) . 37 CFR 1.42 or 1.43

☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached

☐ this is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. *See item 13 below for fee.*

☐ Not Enclosed.

WARNING: Where the filing is a completion in the U.S. of an International Application but where a declaration is not available or where the completion of the U.S. application contains subject matter in addition to the International Application the application may be treated as a continuation or continuation-in-part as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

☐ Application is made by a person authorized under 37 CFR 1.41 (c) on behalf of *all* the above named inventor(s). The declaration or oath, along with the surcharge required by 37 CFR 1.16 (e) can be filed subsequently.

NOTE: It is important that *all* the correct inventor(s) are named for filing under 37 CFR 1.41 (c) and 1.53 (b).

6. Inventorship Statement

WARNING: If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

☒ The same

or

☐ Are not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made.

☐ is submitted

☐ will be submitted.

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of \$30.00 required by 37 CFR 1.17(k) is required to be filed with the application or within such time as may be set by the Office. 37 CFR 1.5(d).

NOTE: A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(b).

☒ English

☐ non-English

☐ the attached translation is a verified translation. 37 CFR 1.52(d).

8. Assignment

- ☐ An assignment of the invention to _____
☐ is attached
☐ will follow

NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment" Notice of May 4, 1990.

9. Certified Copy

Certified cop(ies) of application(s)

(country) (appl.no.) (filed)
from which priority is claimed

- ☐ is (are) attached . A separate "ASSIGNMENT COVER LETTER
ACCOMPANYING NEW PATENT APPLICATION" is also attached
☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35USC120 is itself entitled to priority from a prior foreign application then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10 Fee Calculation (37 CFR 1.16)

A ☒ Regular application

CLAIMS AS FILED			
Number filed	Number Extra	Rate	Basic Fee \$690.00
Total			
Claims 37 CFR 1.16(c)	49-20 = 29	x \$18.00	522.00
Independent			
Claims (37CFR 1.16(b))	4 -3 = 1	x \$ 78.00	78.00
Multiple dependent claim(s), if any			
(37 CFR 1.16(d))		\$260.00	0.00

- ☐ Amendment Cancelling extra claims enclosed.
☐ Amendment deleting multiple-dependencies enclosed.
☐ Fee for extra claims is not being paid at this time.

note: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37CFR1.16(d).

Filing fee calculation \$ 1,290.00

B. _ Design application

(\$310.00 - 37 CFR 1.16(f))

Filing fee calculation

\$ _____

C _ Plant application

(\$510.00 - 37 CFR 1.16(g))

Filing fee calculation

\$ _____

11. Small Entity Statement(s)

☒ **Verified Statement(s)** that his is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

Filing Fee Calculation (50% of A, B, or C above) \$ 645.00

NOTE: any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. 37 CFR 1.28(a).

12. Request for International-Type Search (37 CFR 1.104(d)) (complete, if applicable)

☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made At This Time

☐ Not Enclosed

☐ No filing fee is to paid at this time. (This and the surcharge required by 37 CFR 1.16(e) can be paid subsequently.)

☒ Enclosed

☒ basic filing fee \$ 645.00

☐ recording assignment (\$40.00; 37 CFR 1.21(h)) \$ _____

☐ petition fee for filing by other than all the inventors or person on behalf of the inventor where inventor refused to sign or cannot be reached. (\$120.00; 37 CFR 1.47 and 1.17(h)) \$ _____

☐ for processing an application with a specification in a non-English language. (\$300.00; 37 CFR 1.52(d) and 1.17(k)) \$ _____

☐ processing and retention fee (\$130.00; 37 CFR 1.53(d) and 1.21(l)) \$ _____

☐ fee for international-type search report (\$40.00; 37 CFR 1.21(e)) \$ _____

NOTE: 37 CFR 1.21(l) establishes a fee for processing and retaining any application which is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid or the processing and retention fee of 1.21(l) must be paid within 1 year from notification under 53(d).

Total fees enclosed

\$ 645.00

14. Method of Payment of Fees

- ☒ Check in the amount of \$ 645.00
☐ Charge Account No. _____ in the amount of \$ _____. A
duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner the it is clear for which purpose the fees are paid. 37 CFR 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: if no fees are to be paid on filing the following items should **not** be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 12-0005.

- ☐ 37 CFR 1.16(a), (f) or (g) (filing fees)
☐ 37 CFR 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.16(d)) it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

- ☐ 37 CFR 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later then the filing date of the application)
☐ 37 CFR 1.17 (application processing fees)

WARNING: While 37 CFR 1.17(a),(b) (c) and (d) deal with extensions of time under 1.136(a) this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 C.F.R. 1.136(a) is to avail unless a request or petition for extension is filed." (Emphasis added). Notice of November 5, 1985 (1060 O.G. 27)

- ☐ 37 CFR 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 CFR 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b).

NOTE: 37 CFR 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application...prior to paying, issue fee". From the wording of 37 CFR 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

16. Instructions As to Overpayment

- ☐ credit Account No.
☒ refund

Reg. No.33,948

Tel. No. (415) 949-0418



SIGNATURE OF ATTORNEY

Bo-In Lin

Type or print name of attorney

P.O. Address : 13445 Mandoli Drive,
Los Altos Hills, CA 94022

[illegible]

— — — — —

- Has Added Pages For New Application Translated Where Benefit Of Prior U.S. Application(s) Claimed**

Plus Added Pages For Papers Referred To In Item 4 Above

Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added _____

X Statement Where No Further Pages Added


(If no further pages form a part of this Transmittal then end this Transmittal with this page and check the following item)

- X This transmittal ends with this page

Title: DATA TRANSFER USING TELEVISION VIDEO SIGNAL

Small Entity Declaration - INDEPENDENT INVENTOR(S)

I hereby declare that I am an independent inventor as defined in Section 1.9(c) of 37 CFR. I have not assigned, granted, conveyed or licensed, and am under no obligation under contract or law to assign, grant, convey, or license any rights in the invention to any person who could not likewise be classified as an independent inventor if that person had made the invention, or to any concern which would not qualify as small business concern or a nonprofit organization.


Signature of the First/(Sole) Inventor

3/29/2000
Date

DATA TRANSFER USING TELEVISION VIDEO SIGNAL

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The present invention relates to information transfer methods, and more particularly to transfer methods using television (TV) video signals.

10 2. Description of the Reference Art

It is very clear that Internet is bringing revolutionary changes to human life. The world-wide-web allow easy individual access to information at anywhere in the world. It brings tremendous opportunities in business, revolutionary changes in education, and it will certainly change every aspect of our life style.

As Internet access gets more and more popular, data transfer bandwidth becomes a major problem. Today, telephone lines are still the major media for individual Internet connections. The 2.4 KHZ (thousand cycles per second) bandwidth for an end-user telephone line was adequate for voice transfer, but it is not designed to transfer large amount of data. Computer modem devices have been upgraded to 56 Kbps (thousand bits per second), but it is still far too slow. Many solutions have been proposed to solve the bandwidth problem. Among them, Integrated Services Digital Network (ISDN), fiber to home, and cable to home have been implemented at selected areas. However, those proposed new methods require tremendous amount of resource to implement, and it will take many years before it can reach individual users. Those new methods also represent tremendous wastes due to the burst nature of Internet access. An individual user would like to have a large bandwidth while accessing data, but most of time the individual line is not in use. An optical fiber to home is therefore a waste in bandwidth for most of time. Another important fact is that the bandwidth requirement from the user to the provider is usually very low. A human being can send out just a

few commands per second. High bandwidth is often needed after the user request large amount of data from the provider. Providing the same bandwidth for both directions is therefore a waste. Further more, those new methods do not really solve the bandwidth problem for popular data providers. When thousands or millions of users request a popular web page at the same time, the provider does not have enough bandwidth to send out so many copies of data even if it is equipped with optical fiber.

The present invention provides a solution that can solve most of the bandwidth problems now. The proposal is to utilize existing TV networks to transfer data. Combining all the TV channels, the total bandwidth of TV signal is about one million times higher than a telephone line. The TV network already reaches nearly everyone in the world; it requires no new investment to implement. Since TV system is a one-way broadcast system, we will still need the telephone system to transfer low bandwidth tasks, while using TV to transfer most of data from providers to users. This combination of TV and telephone networks has enough capability to solve most of existing problems. The major challenge for this proposal is that almost all the bandwidth of TV channels has been used to transfer images to TV. Watching TV has been an important part of modern human life; any change in existing TV system will certainly encounter strong resistance. It is therefore strongly desirable to provide methods to transfer high bandwidth data using TV system without influencing TV viewers.

Existing television (TV) signal transfer methods are first reviewed to facilitate understanding of the issues. TV signal contains timing and color information to control the scanning electron beam hitting on a TV screen. Figs. 1(a-g) shows the relationship between TV image and TV signal. Each picture is divided into a plurality of horizontal lines. The picture is created line by line with a scanning electron beam. Each line is composed of a plurality of picture elements (pixel). The size of each pixel is defined by the resolution of the image. For a color TV, a pixel is actually composed of three dots of three primary colors (red, green, and blue). The light density and color of each pixel is determined by the strength and location of the scanning electron beam in TV tube, which is

controlled by the TV signal. Nearby lines belong to two separated frames. Half of the lines are scanned on the screen first, while the electron beam goes back to the upper left corner to scan the other half of interleaved lines. Display of 30 pictures or 60 frames in every second creates a motion picture.

FIG. 1(b) shows a snapshot of a typical TV signal waveform after it is demodulated. For every 1/60 seconds, a vertical synchronization (V sync) signal (111) marks the time when the scanning beam need to go back to upper left corner of the screen. The duration of this vertical sync signal, called "vertical blank interval" (112), is the time when the scanning beam needed to move from lower right corner back to upper left corner. There is a 15.75 KHZ horizontal synchronization (H sync) signal (113) that determines the time when the scanning beam should start on a new line. The duration of the horizontal sync signal called "horizontal blank interval" (114) is the time when the scanning beam move back from the right side of the screen to the left side to start on a new line. Video signal for one line of image (115) is transferred between horizontal sync signals. The amplitude of video signal varies between 0.3 to 1 volts. A voltage at 1 volt (white level) represents the brightest white color, while a voltage at 0.3 volts (black level) represents totally black. The voltages for both the vertical sync and the horizontal sync are at zero volts, which is called the "blank level". The 0.3 volts difference between black level and blank level is designed to avoid false image during vertical and horizontal blank intervals.

For a black and white TV, the amplitude of the video signal (115) represents the light intensity along one horizontal line. It also includes frequency modulated (FM) audio signals. The video signal for color TV is more complex. Besides the FM audio signal, the color video signal contains three sets of signals as

$$Y = 0.3R + 0.59G + 0.11B \quad (1)$$

$$U = 0.493(B-Y)p \quad (2)$$

$$V = 0.877(R-Y)q \quad (3)$$

where R is the red light intensity, G is the green light intensity, B is the blue light intensity, Y is called the "luminance signal" that is equivalent to light density adjusted by color sensitivity of human eyes, U is the blue color differential signal, p is a phase factor representing a phase shift and a 4.43 MHZ carrier frequency shift, V is the red color difference signals, q is equal to p plus 90 degree phase shift. These signals are merged into the same bandwidth originally designed for black and white TV signals. The Y signal defines contrast of the image, so it occupies wider bandwidth, while U and V signals occupying narrower bandwidth. FIG. 1(c) shows the spectrum of one channel of TV signal. The audio signal is carrier by a narrow side band 6 MHZ (million cycles per second) above basic carrier frequency (CF). The luminance signal (Y) occupies spectrum between CF and audio side band. The color difference signals (U, V) occupies a side band centered at 4.43 MHZ above CF. The spectrum peaks of the color difference signals is carefully inserted between that of the luminance signals to minimize interference. This is possible only because the amplitudes of color difference signals (U, V) often follow that of luminance signal (Y). The color TV also uses another timing signal called "color burst" (117). The color burst (117) is placed at the back porch between the horizontal sync pulse and the start of video signal as shown in FIG. 1(b). The color TV signals are defined in this way in order to be compatible with black and white TV.

Besides sound and image, other types of information have been transferred through the TV signals taking advantage that part of those signals are not displaced on TV screen. For example, special binary signals are inserted into the "spare" time during the vertical blank interval to carry text. The video image near the edge of the TV screen is usually not displayed. It is therefore possible to transfer data through those "unused" lines. For example, TV signal line 7-18 and 320-331 are used to carry text signals that are only recognizable with special decoding circuits. For another example, TV decoder circuits replace Lines 22-24 and their companions lines 334-336 by special signals used for automatic gray scale compensation.

5 All these video, audio, timing, and special signals are all transferred by modulating high frequency carrier signals within a pre-defined standard bandwidth (~8 MHZ). Signals from hundreds of TV channels are transferred in parallel using carefully defined carrier frequency; each channel occupies a well-defined bandwidth to avoid interference.

10 From the above descriptions, it is clear that all available bandwidth of TV system has been fully occupied. People already explored all kinds of methods to insert more information into the limited TV bandwidth. Using conventional methods to insert data into TV signals is therefore likely to cause interference. It is therefore highly desirable to invent novel methods to transfer high bandwidth data using TV signals without influencing the programs displayed for TV viewers.

15 SUMMARY OF THE INVENTION

20 The primary objective of this invention is, therefore, to provide practical methods to transfer data using TV signals without disturbing TV viewers. The other objective is to provide effective methods to find available bandwidth for data transfer methods of the present invention. Another objective is to provide methods to compensate the distortion caused by such data transfer. Another important objective is to provide methods to improve tolerance in noise. It is also a major objective of the present invention to provide efficient methods to work with other data transfer methods.

30 These and other objectives are accomplished by novel methods in overlapping data signals with TV signals without causing sensible disturbs in TV image displays.

While the novel features of the invention are set forth with particularly in the appended claims, the invention, both as to organization and content, will be better understood and appreciated, along with other

objects and features thereof, from the following detailed descriptions taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

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Figs. 1(a-g) show relationships between current art TV signal and TV display;

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FIG. 2(a) is an example of a TV video signal with low contrast areas;

FIG. 2(b) is an example of the spectrum for a low contrast area;

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FIG. 2(c) illustrates the spectrum after frequency modulated data signal has been inserted into the low contrast area in FIG. 2(b);

FIG. 2(d) illustrates the spectrum after multiple frequency data signal has been inserted into the low contrast area in FIG. 2(b);

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FIG. 2(e) shows an example when amplitude modulated data signal is inserted into a low contrast area in FIG. 2(a);

FIG. 2(f) shows an example when compensated amplitude modulated data signal is inserted into a line next to the line in FIG. 2(e);

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FIG. 2(g) shows an example when compensated amplitude modulated data signal is inserted into a low contrast area in FIG. 2(a);

FIG. 2(h) is an example of differential amplitude data signal;

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FIG. 3(a) is the block diagram for a low contrast area data transfer system of the present invention;

Figs. 3(b-d) are examples for the video signals in FIG. 3(a);

Figs. 4(a-c) are examples for the video signals of black level data transfer method of the present invention;

5 Figs. 5(a-c) are examples for the video signals of white level data transfer method of the present invention;

Figs. 6(a-c) are examples for the video signals of blank level data transfer method of the present invention;

10 Figs. 7(a-c) are the float charts for color table data transfer, pre-defined object data transfer, and invisible frame data transfer procedures;

FIG. 8(a) is a high level block diagram for a communication system of the present invention;

15 FIG. 8(b) is a block diagram for the layer structures of a communication system of the present invention; and

20 FIG. 9(a) shows the block diagram for a video game controller of the present invention;

FIG. 9(b) shows the float chart of the communication procedure for the controller in FIG. 9(a); and

25 FIG. 10 illustrate a real-time stock price update system of the present invention

DETAILED DESCRIPTION OF THE INVENTION

30 The relationship between TV image and TV signal is described in further details to facilitate understanding of the present invention. FIG. 1(d) shows the video signal waveform for one line (121) of the TV image displayed in FIG. 1(a). At the end of each line, an H sync (125) indicated the end of one line, and the electron beam is move back to the left side of
35 the screen during the horizontal blank interval. The value of the TV signal during this interval is at blank level (0 volt). Each line begins when the

signal returns from blank level to black level (0.3 volt). For a color TV signal, a color burst (127) composed of several pulses between blank and black levels is used to indicate the timing relationships between color (U, V) signals and luminance signal (Y). The signal stays at black level, then starts to vary from 0.3 to 1 volts to transfer the video signal on the line. A video signal at 0.3 volts means total black; there should be no light emitted from corresponding pixel. A video signal at 1 volt means white color at the highest luminance level of TV screen. Video signals between 0.3 and 1 volt represent various kinds of color and luminance. Areas where the video signal changes slowly along horizontal direction are called "horizontal low contrast" area. Areas where the video signal changes dramatically along horizontal direction are called "horizontal high contrast" areas (129) as marked by dashed lines in FIG. 1(d).

After the electron beam scans to the lower right corner, the beam is moved back to the upper left corner during the V sync interval. This motion is synchronized by the V sync signal (111) as shown in FIG. 1(b). The V sync signal (111) contains a plurality of pulses varying between blank and black levels. Sometimes, these pulses are also used to carry special information such as binary code for text display.

After the V sync interval, the electron beam starts to scan lines on a new frame, which are interleaved lines on the same picture of previous frame. FIG. 1(e) shows the video signal for a line (122) that is right next to the line in FIG. 1(d). This line belongs to the same picture at a different frame. Typically, the video signals for nearby lines are very similar; the signal only changes at positions where vertical image is changing. Areas where the video signal changes slowly along vertical direction are called "vertical low contrast" area. Areas where the video signal changes dramatically along vertical direction are called "vertical high contrast" areas (139) as marked by dashed lines in FIG. 1(d). Note that horizontal high contrast area is not necessary a vertical high contrast area. Similarly, a horizontal low contrast area can be a vertical high contrast area.

After the second frame is scanned, the electron beam starts to scan the image of the next picture after the V sync interval. FIG. 1(f) shows the video signal for the same line (121) as the line in FIG. 1(d) but for the next picture. Typically, the video signal of nearby pictures does not change much; the signal only changes at positions where image is changing with time. For the example in FIG. 1(a), only the bat of the baseball player is moving. Therefore, the video signal only changes around the bat. Areas where the video signal changes slowly with time are called "low moving contrast" area. Areas where the video signal changes dramatically with time are called "high moving contrast" area (149) as marked by dashed lines in FIG. 1(f).

Human eyes are sensitive to high contrast (horizontal, vertical, and moving) areas. Details in the low contrast areas are usually ignored. One example to illustrate the importance of the high contrast areas is text. FIG. 1(g) shows the video signal of one line (123) that displays the text box (107) on FIG. 1(a). In this example, text characters are displayed by using two monochromatic colors: the foreground color and the background color. Within the text box (107), the amplitude of the video signal in FIG. 1(f) stays constant until it hits the edges of character frames. The only high contrast area is therefore at the edges of character frames. For texts, characters are recognized correctly as soon as the edges of character frames are marked with high contrast area. Changes in the foreground and background areas will not change the information passing to us. Another important fact is the describing a two-color picture only needs two kind of signals; that means we do not need a lot of bandwidth to display simple objects like text. Text is just an example easy to understand. It is generally true that small changes in the low contrast area will not influence the information received by viewers. From signal processing point of view, the bandwidth reserved for each TV channel is defined to be enough to describe high contrast objects, while the low contrast areas do not require the same bandwidth. That means there are available bandwidth to transfer other information whenever the image has low contrast areas. The present invention provides methods to replace TV video signal with data signal while the resulting broadcast

Low Contrast area Data Transfer (LCDT)

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useful because the result of frequency modulation will expand the bandwidth occupied by the video signal, causing distortion. In a low contrast area, we have available bandwidth to carry FM data signal without causing problem. FIG. 2(c) shows the spectrum when the video signal in FIG. 2(b) is carrying FM data. The effect of FM data modulation widens the spectrum peaks (221, 222). The effect of the data signal will not cause any change in video information as soon as the spectrum peaks are not wide enough to interfere with one another. Note that the luminance peak (221) and the color peak (222) can carry different sets of FM data separately. This frequency modulation to carry data signal does not influence the FM audio signal because the audio signal is carried by CF + 6 MHz side band.

A variation of FM format is the Multiple Frequency (MF) format. FIG. 2(d) shows the spectrum for one example of MF data. There are 4 luminance peaks centered at four frequencies (F0, F1, F2, F3). Data are represented by carriers of different frequencies within the bandwidth of the TV channel. For example, carrier frequency F0 represents binary data '00', F1 represents '01', F2 represents '10', and F3 represents '11'. The amplitude of MF signal still can follow the original video signal. Based on the same principle, the color signal also can carry a different set of MF format data. For example, color signal centered at F4 carries binary data '0'; color signal centered at F5 carries binary data '1'.

Similar to the concept of FM signal, the data may be transferred by modulating the phase of the data carrier. This method is called Phase Modulated (PM) data transfer. Data are represented by the phase change in the carrier signal. A variation of PM data is the multiple phase (MP) data format. Data are represented by video signals with discrete phases.

Low contrast-area data transfer (LCDT) in frequency modulated formats such as transferred in FM, MF, PF, or MP format has the advantage that the amplitude of the original video signal remains the same. It is therefore possible to transfer data in the low contrast areas without any change in the video information. On the other hand, human

eyes are not sensitive to small changes in a low contrast area. It is therefore possible to insert amplitude modulated (AM) signal in the low contrast area. FIG. 2(e) shows an example when an AM data signal (253) is inserted into one of the low contrast areas (251) of the video signal in FIG. 2(a). One problem for inserting data into video signal is that it may create a random background color fluctuation on the TV image. Although a TV viewer will have no problem recognizing the original image, this background fluctuation can be annoying. The present invention provides methods to solve this problem. One solution is to transmit data in compensated formats (CF). For each data modulation done on one pixel, opposite modulation is done on a nearby pixel to compensate it. Since human eyes automatically takes averaged images of fine objects, the resulting image of compensated format will be very close to the original image. There are three ways to transmit CF format data. The first way is to put the AM data of opposite amplitude in a nearby line. When the CF data is implemented on a nearby line, it is called "vertical compensation" (VC). The pre-requirement for VC is that both lines need to have vertical low contrast areas. The same method can be implemented on nearby pictures. When the compensating data is carried by the same line at a different picture, it is called "time compensation" (TC). The pre-requirement for TC is that both lines need to have low moving contrast areas. FIG. 2(f) shows a line of video signal that is carrying VC or TC data signal (254) compensating for the AM data (253) in FIG. 2(e). The third CF method is to carry the compensated data in nearby pixels on the same line. This format is called horizontal compensation (HC). FIG. 2(g) shows an example HC data (255). Naturally, we can use a combination of those three compensation methods (HC, VC, TC) to represent data. Also note that each point on the screen actually has three colors (R, G, B). The compensated format data (253-255) shown in Figs. 2(e-g) are simplified for clarity. There are actually three degrees of freedom to represent and to compensate the modulated data. Data compensation can be implemented on one or more of the color components. The amplitude of the video signal is also not necessary linear proportional to the amplitude of light. Therefore, a proper compensation signal also needs to take alpha correction into consideration.

These compensation techniques (HC, VC, TC) not only improve picture quality, but also improve noise tolerance. When data is carried by compensated format, the data is determined by the changes in nearby points. Since most noise will have the same effects on nearby points, the resulting data signal has much better signal to noise ratio. This improvement in signal to noise ratio can allow us to carry more data in each point. The net result in data carrying capability is therefore not necessary worse than uncompensated data format.

Using compensated format, at least two pixels are required to carry each data point. In case it is not desirable to use multiple pixels to carry one data point, a differential format (DF) can be applied to solve the problem. FIG. 2(h) shows an example of data signal in differential amplitude (DA) format. Binary data '1' is represented by a change in amplitude in either up or down direction, and binary data '0' is represented by no change. If a parity bit is carried in every 8 data bits, it can be arranged to have the average amplitude to be zero for every 9 bits. The resulting disturbance in the original signal is therefore smooth and negligible. Similarly, the differential format can be employed to carry data signals with an FM, MF, PM, or MP formats. Naturally, combinations of multiple data formats, e.g., combinations of FM, MF, PM, MP, AM, CA, DA, can be employed to achieve higher data transfer rate when necessary.

FIG. 3(a) shows the block diagram for a hardware system executing a low contrast area data transfer (LCDT) process. A video signal analyzer (VSA) examines the outgoing video signal (OVS) looking for available bandwidth. This video signal analyzer detects changing rate of the outgoing video signal (OVS). Whenever low contrast areas are detected, the VSA sends signals to a signal processor. In the mean time, the data providers also send data to the signal processor for data transfer. This signal processor inserts outgoing data signal (ODS) into the outgoing video signal (OVS) to create broadcast video signal (BVS). The BVS is broadcast through TV systems. Both TV users and data users receive and process the broadcast video signal. Data transfer methods of the present invention preserve the quality of video signal. The TV receivers process

the BVS the same way as before, not affected by the data signal carried along with the broadcast video signal, to display high quality pictures with the processed BVS. The data receiver has a data signal analyzer (DSA) and data decoder. The DSA examines BVS and sends out a signal to the data decoder whenever data signal is found. The data decoder filters the right signal out of BVS, and extracts the correct data for the data user.

As an example, after processing the video signal shown in FIG. 3(b), the output generated by a low contrast area data transfer (LCDT) VSA would look like FIG. 3(c). Whenever the signal in FIG. 3(b) has a changing rate less than a pre-defined limit, the output of the level sensor is binary '1', otherwise it is '0', as shown in FIG. 3(c). There are three low contrast areas (311-313) in the video signal of the example in FIG. 3(b). In the mean time, the areas allowed for timing control signals, e.g., vertical sync, horizontal sync, and color burst, automatically meets the requirements for a low contrast area. Therefore, the signal in FIG. 3(c) also goes high during the horizontal blank interval. When OVS stay in low contrast area long enough to carry data, data signal is inserted to create the BVS as shown in FIG. 3(d). The data can be transferred using any one or any combination of the formats (FM, PM, MF, MP, DA, CA, CP) of the present invention. The LCDT data signal analyzer (DSA) also has the capability to detect low contrast area. Whenever a low contrast area is found, the data decoder will look for overlapped data signal, and extract the data by demodulation procedures.

The optimum data transfer rate of LCDT is strongly dependent on the video signal. Higher data rate can be achieved for special types of TV signals. For example, special data transfer rate can be achieved when the low contrast area is at black level. A Black Level Data Transfer (BLDT) method is disclosed in the present invention to take advantage of the special data transfer rate achievable in the black-level low contrast area. Similarly this invention also applies a White Level Data Transfer (WLDT) method by taking advantage of the higher data transfer rate in a white-level low contrast area. Furthermore, this invention also discloses a Blank Level Data Transfer (KLDT) method carry the data signals in a blank-level

low contrast area. FIG. 3(d) shows example for the situations when BLDT (331), WLDT (332), common LCDT (333), KLDT (334) are used for the example video signal in FIG. 3(b). These data transfer methods at extreme cases (BLDT, WLDT, KLDT) are described in further details hereafter.

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Black level data transfer (BLDT)

Video signals with a voltage level representing the black color are one of the signals most frequently transmitted to the TV receivers. Black as a color is frequently displayed on TV screen. Also, the signal's voltage level is applied as the upper level for video timing signals (H sync, V sync, color burst). In optical terms, black means no light. When the video signal is at black level, the corresponding picture element (pixel) should be totally black on the TV screen. According to optical concept, it is impossible to have a color darker than black. For TV signals, Black level is represented by an amplitude-modulated (AM) signal at 0.3 volts. The black level is set at 30% of full-scale amplitude because there is a need to have enough margin to define the "blank level" used for timing signals. Ideally, a video signal should never have a value between black level and blank level because nothing can be darker than black while it is not a timing signal.

In reality, a video signal lower than black level will be processed by the receiver as black, immediately after the receiver circuits detect a video signal level lower than the black level. In practical conditions, a spot on the TV screen can not be totally black; the TV screen may reflect lights from nearby light source even when the screen itself is not emitting light. Therefore, a video signal slightly higher than black level can be treated as black in practical conditions. The concept of "black" is therefore not strictly defined as represented by one-and-only signal level. The TV signals with amplitudes between lower black level and upper black level represent the same signal as far as TV display is concerned. It is therefore very convenient to carry along data signals with a signal representing black spots for TV display. The only limitation is to have the overlapped signals remain within the black level range. It should also be noted that

the black level range is not a fixed signal range. At areas right next to a timing signal, the black level need to be accurate; at other areas, black level range can be very wide. The exact value for black level range is also dependent on the design of TV receiver circuits.

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Another important factor is that black is not processes as a color signal and mathematically black signal means $R=G=B=Y=U=V=0$. Therefore, there are full freedom to represent black using different carrier signals, as soon as the resulting amplitude fall between the upper and lower black levels.

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To support BLDT, the VSA and DSA need to have a level sensor. This level sensor examines the video signal, and sends out a control signal whenever the video signal is within black level range. Using the video signal in FIG. 4(a) as an example, the BLDT signal analyzer output would look like FIG. 4(b). Whenever the signal in FIG. 4(a) is within black level range, the output of the level sensor is binary '1', otherwise it is '0', as shown in FIG. 4(b). When the video signal is found to stay within black level range long enough to carry data, data signal is inserted into the original video signal to create the video output signal as shown in FIG. 4(c). One obvious problem for the AM data signal in this example is noise sensitivity. The black level range is only a fraction of full-scale amplitude. The signal to noise ratio is therefore much smaller than TV signals. One solution to solve the noise problem is to use frequency modulation methods. Since black level does not have color information, we can change phase and frequency without influencing the quality of video display. Using FM methods we can keep the amplitude of the black level signal at 0.3 volts, while carrying high bandwidth data signal with FM, MF, PM, or MP methods described in previous sections. Because the amplitude of data signal is 0.3 volts, excellent signal to noise ratio can be achieved.

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A narrow side band within the TV channel to carry the AM signal can be employed to improve noise tolerance for amplitude modulated black level data transfer (AMBLDT). A filter can also used to filter out most of noise at other frequencies and a compensated or differential

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White level data transfer (WLDT)

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range, the output of the level sensor is binary '1', otherwise it is '0', as shown in FIG. 5(b). When the video signal is found to stay within black level range long enough to carry data, data signal is inserted into the original video signal to create the video output signal as shown in FIG. 5(c). The data can be transferred using any one or any combination of the formats (FM, PM, MF, DA, CA, CP) described in previous sections. Unlike BLDT, for WLDT selection of the phase and frequency of the carrier signal need to take color into consideration.

Blank level data transfer (KLDT)

Blank level is used for timing signals such as horizontal sync, vertical sync, and color burst. Blank signal should have zero amplitude. In reality, timing circuits are most sensitive to the falling and rising edges of the timing signals. Other than those edges, timing circuits can tolerate signals with amplitude smaller than the blank level limit as blank signal. Therefore, we can insert data signals to replace blank signals as soon as the amplitude of the inserted signal is lower than the blank level limit.

To support KLDT, the VSA and DSA need to have a level sensor. This level sensor examines the video signal, and sends out a control signal whenever the video signal is below blank level limit. Using the video signal in FIG. 6(a) as an example, the KLDT signal analyzer output would look like FIG. 6(b). Whenever the signal in FIG. 6(a) is below blank level limit, the output of the level sensor is binary '1', otherwise it is '0', as shown in FIG. 4(b). When the video signal is found to stay within blank level range long enough to carry data, data signal is inserted into the original video signal to create the video output signal as shown in FIG. 6(c). The data can be transferred using any one or any combination of the formats (FM, PM, MF, DA, CA, CP) of the present invention. Similar to BLDT, we have total freedom to select the phase and frequency of the carrier signal because blank level does not have color.

The data transfer methods using the available bandwidth in the low contrast areas (LCDT, BLDT, WLDT, KLDT) have been disclosed in

the above sections. Those methods provide data transfer bandwidth whenever the video signal is in low contrast areas. The average data transfer rate is therefore dependent on the property of TV image. For many types of applications, it is desirable to have a steady data transfer rate. Therefore, the present invention provides data transfer methods with transfer rate independent of the TV image, as disclosed hereafter.

Color Table data transfer (CTDT)

Color table is commonly used for computer display as a method to reduce the size of graphic files. A color table defines a finite number (16, 64, or 256) of colors. The color of each pixel in a picture is represented by one of the color in the color table that is closest to the original. For most cases, a 256-color table is adequate to display high quality pictures, especially when the content of the color table can be changed to adapt for different pictures. Definition of the colors in the color table is not unique. We can replace every entry of a color table with similar but different colors to create another table. The new table will still be able to represent high quality pictures. This property is used by a data transfer method of the present invention called color table data transfer (CTDT).

To support CTDT, both the data provider and data receiver need to agree upon two or more pre-defined color tables, e.g., T0 and T1 where T0 represents the first color table and T1 represents the second color table. These color tables can be changed but all the tables need to be coherent. FIG. 7(a) shows the flow chart for CCTDT procedures. A video signal analyzer (VSA) determines the color for each pixel in the original video signal (OVS). For transmitting a binary number '0', the color of the pixel is replace by the best fit in table T0, and for transmitting a binary number '1', the color of the pixel is replace by the best fit in table T1. The resulting picture (BVS) is broadcast through TV network. Since both color tables T1, T0 are provided for producing high quality pictures, the resulting mixed video signal will be able to provide high quality display for TV viewers. A data receiver uses a data signal analyzer (DSA) to examine the BVS. When the color of a pixel is found in T0, a binary number '0' is

[illegible]

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99																																																							
0	00000000	00000001	00000002	00000003	00000004	00000005	00000006	00000007	00000008	00000009	0000000A	0000000B	0000000C	0000000D	0000000E	0000000F	00000000	00000010	00000011	00000012	00000013	00000014	00000015	00000016	00000017	00000018	00000019	0000001A	0000001B	0000001C	0000001D	0000001E	0000001F	00000020	00000021	00000022	00000023	00000024	00000025	00000026	00000027	00000028	00000029	0000002A	0000002B	0000002C	0000002D	0000002E	0000002F	00000030	00000031	00000032	00000033	00000034	00000035	00000036	00000037	00000038	00000039	0000003A	0000003B	0000003C	0000003D	0000003E	0000003F	00000040	00000041	00000042	00000043	00000044	00000045	00000046	00000047	00000048	00000049	0000004A	0000004B	0000004C	0000004D	0000004E	0000004F	00000050	00000051	00000052	00000053	00000054	00000055	00000056	00000057	00000058	00000059	0000005A	0000005B	0000005C	0000005D	0000005E	0000005F	00000060	00000061	00000062	00000063	00000064	00000065	00000066	00000067	00000068	00000069	0000006A	0000006B	0000006C	0000006D	0000006E	0000006F	00000070	00000071	00000072	00000073	00000074	00000075	00000076	00000077	00000078	00000079	0000007A	0000007B	0000007C	0000007D	0000007E	0000007F	00000080	00000081	00000082	00000083	00000084	00000085	00000086	00000087	00000088	00000089	0000008A	0000008B	0000008C	0000008D	0000008E	0000008F	00000090	00000091	00000092	00000093	00000094	00000095	00000096	00000097	00000098	00000099

[illegible][illegible]

Small Object data transfer (SODT)

Human eyes are not sensitive to a small object on a large picture. If we select a few pixels on the screen to carry data, the effect of the data won't be visible as soon as the selected area is small enough. These small objects can be placed at a fixed place on the screen. It also can be a moving small object. The location even can be randomly selected as soon as both the sender and the receiver knows which pixels are carrying data. We have total freedom to use any combination of data formats of the present invention within the small object. Any combinations of the data formats of the present invention can be used for SODT. The data transfer procedures for SODT is the same as PODT as shown in the float chart in FIG. 7(b).

Invisible frame data transfer (IFDT)

Not all the video signals are displayed on TV screen. The first and last few lines of each frame are not displayed. The first and the last few pixels of each line are not displayed. Those lines and pixels outside of TV screen (109) are called the "invisible frame" (108). We can replace video signals in this "invisible frame" (108) with data signals as soon as (1)the spectrum of the data signal is within the bandwidth of the TV channel, (2)the amplitude of the data signal is within the ranges of conventional video signal, and (3)the timing signals (V sync, H sync, color burst) are preserved correctly. A data transfer method of the present invention using the invisible frame for data transfer is called "Invisible Frame Data Transfer" (IFDT). Since the video signal in the invisible frame is not used for TV display at all, there is highest degree of freedom in the data transfer format for IFDT. It is important to remember that there are prior art methods using part of the invisible frame to carry text. These prior art text signals always use blank level and black level. One way to maintain compatibility is to use BLDT and KLDT when the signal in the invisible frame is found to be at black level or blank level. For other levels, we have total freedom to use any combination of data formats of the present invention.

To support IFDT, the video signal analyzer (VSA) and the data signal analyzer (DSA) need to have a timing circuit. This timing circuit uses the video timing signals (V sync and H sync) and an internal timer to determine if the signal is within the invisible frame. When the video signal is found to stay within the invisible frame, data signal is inserted into the original video signal to create the video output signal. The data can be transferred using any one or any combination of the formats described in previous sections. FIG. 7(c) shows the float chart for one example of IFDT procedure.

Dedicated object data transfer (DODT)

While data transfer methods of the present invention is able to transfer data through TV signals without degrading picture quality, it is still not ethical to change the video signal without notifying TV viewers. Honesty is the best policy. We should always notify the TV viewers whenever we are using the video signal to transfer data. One way to do that is to display a special symbol (101) on one corner of the screen as shown in FIG. 1(a). In this example, we use characters "DT" to notify TV viewers that data transfer is executed. In case that the data transfer procedure indeed causes annoying effects, the TV viewers can feedback the problem to the data provider, and the data transfer methods should be improved. Naturally, the DT symbol (101) can be used for data transfer. One of the simplest methods to transfer data is to dedicate a small portion of the TV screen for data transfer. This method is called Dedicated Object Data Transfer (DODT) method. The data transfer procedures for DODT is the same as PODT as shown in the float chart in FIG. 7(b).

The present invention provides effective methods to utilize the TV network as a parallel path for Internet communication. Combining the data transfer methods (BLDT, WLDT, KLDT, VSDT, CTD, PODT, SODT, IFDT, DODT) of the present invention, more than 90% of the TV bandwidth will be available for data transfer. The bandwidth for each pixel on a TV screen is about equal to 6 phone lines. If all the available TV

channels are fully utilized, more than one billion bits per second (Gbps) is transmissible to every user in the world.

5 While specific data transfer methods of the invention have been illustrated and described herein, it is realized that other modifications and changes will occur to those skilled in the art. It should be understood that the above particular examples are for demonstration only and are not intended as limitation on the present invention.

10 A data transfer system of the present invention does not replace existing communication systems. Instead, it provides additional data path to existing systems. FIG. 8(a) shows a broad view of a communication system of the present invention. Information users (801) and information providers (803) are connected through Internet. Currently, the backbone of Internet is built on telephone systems and computer networks. In the mean time, TV stations (805) broadcast video signals to TV viewers. Currently, there are no connections between Internet and TV networks. Information users (801) send requests, commands, selections, and simple e-mails through the Internet. Usually those activities require little bandwidth; a simple telephone line is more than enough to handle them. Currently, the information providers (803) also use Internet for data transfer. The bottle neck is the bandwidth requirement for a popular Web site to send large data files to users. The present invention provides an alternative data path. Information provider can send data to a TV station with a data encoder of the present invention. This data encoder contains a video signal analyzer (VSA) and a video signal processor (VSP). The video signal analyzer (VSA) examines the outgoing video signal (OVS) looking for available bandwidth. The output of VSA is sent to VSP to select proper data transfer methods. This signal processor (VSP) inserts outgoing data signal (ODS) into the outgoing video signal (OVS) to create broadcast video signal (BVS). The BVS is broadcast through TV systems, and it is processed by both TV receivers and data users (801). Data transfer methods of the present invention preserve the quality of video signal, so that the TV viewer still can receive high quality video display using BVS. The data receiver has a data signal analyzer (DSA) and data

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decoder (807). DSA examines BVS and sends out a signal to the data decoder (807) whenever data signal is found. Control information such as the type of data transfer and the encoding keys are provide by the information providers (803) either through Internet or transferred as part of ODS. The data decoder (807) filters the right signal out of BVS, and extract the correct data for the data user. This alternative data path through TV network has much wider bandwidth then the telephone networks. It is therefore possible to improve overall system performance dramatically. FIG. 8(b) shows the layer structure of the system in FIG. 8(a). Most of the layer structures and communication protocols are the same as those of current art communication systems. There are no changes on application, presentation, session, and transport layers. Therefore, a communication system of the present invention can use most of existing software and hardware. The present invention provides one way parallel paths in the lower level layers.

The system in FIG. 8(a) can be used in a wide variety of communication applications. We will use a video game rental system as an example to demonstrate operation principles for communication systems of the present invention. FIG. 9(a) shows the block diagram for a video game controller of the present invention. This video game controller is equipped with a TV signal interface (901) for receiving television signals. Typical examples for this TV signal interface (901) are connections to TV antenna or cable TV box. TV signal received by the TV interface (901) is sent to a data decoder (903). The data decoder (903) is used to extract data from TV signal. This video game controller is also connected to an Internet interface (905). A typical example of an Internet interface is a computer equipped with modem. This Internet interface also can be placed inside of the video game control box. Both the Internet interface (905) and the data decoder (903) are connected to a storage unit (907) and a video game control unit (909). The storage unit (907) is a memory device used to store data. Typical examples of the storage unit are hard disk or tape. The video game controller (909) is the same as current art video game controllers except that it has programmable

firmware to allow re-configuration for different games. Video game players can play different games by programming the controller firmware.

5 For a system which does not have TV interface (901), a player need to scan the web side of a video game provider, then load the whole set of a video game program into the game controller (909) in order to play a new game. If there are 1 million players wanting the same game, the same procedures will be repeated one million times. Most likely the web site will be jammed by requests for popular games. Even if the web side has
10 enough bandwidth to handle the request, it is still a tremendous waste in resource.

When the system is equipped with TV interface (901), the procedures to obtain a new game will be extremely efficient. The video
15 game player uses the Internet interface (905) to select a new game. The game provider sends a "decoder key" to the player. This "decoder key" tells the data decoder (903) when and how to down load data from the TV interface (901). High volume data such as the video images of web pages and the game programs are transferred through the TV interface using
20 data transfer methods of the present invention. The Internet interface (905) only handle slow activities such as selection of game or transfer of the decoder key. The same decoder key can be given to multiple users, so that when many users are requesting for the same data simultaneously, the provider only need to send one copy through the TV interface. A data
25 transfer that is initiated immediately after a request from the user is called a real time (RT) data transfer. One problem for RT data transfer is that players usually send out their requests at different time. If the provider always send out the data from the very beginning whenever a request is received, the same data will need to be sent many times. One way to
30 solve the problem is to delay the data transfer, accumulate many requests, then send one copy out to satisfy all the requests. This method is called delayed data transfer. The other way to solve the problem is to break a large file into small packages. The game players do not need to receive a large data file from the beginning. Small packages can be received out of
35 sequence. The final data file is established after all packages are received.

This method is called package data transfer. Using package data transfer, the game provide simply keep on sending out packages of requested games as soon as there are requests for that game. All the players requesting the same game are given the same key. Whenever a player has collected all the necessary packages, a signal is sent back to the provider to notify end of request. The game providers stop the procedure when all the requests are satisfied. Another method to solve the problem is to schedule the TV data transfer ahead of time. This method is especially useful for introduction of a brand new game. All the players wanted the new game are given a key to access the data. Data for the new game is sent out at a pre-defined time to all players. In this way, the provider only needs to send one copy once. Another method is for the provider to send data to players who are likely to want the data before the player actually request for the game. These pre-sent data are stored in the data storage unit (907). When the player actually send out a request, game control software will first look into the storage unit (907). If the game already pre-sent into the storage unit, the provider only needs to give the player a key to activate the game; there is no more need for data transfer. Only when the requested game is not found in the storage unit (607) does the provider need to send new data to the player. FIG. 9(b) shows a float chart for the above communication procedures. The data transfer methods of the present invention are so efficient that they can support thousands of people playing the same game simultaneously. To support such a large scale game, each video game system should store the game map. Players send commands through conventional Internet connections, while a central system update the results through TV data transfer methods of the present invention. The TV signal updates all the game maps in all the involved individual systems with a single broadcast. In this way, thousands of people can play the same game without jamming the system.

Another practical application of the present invention is a real-time stock market data update system. FIG. 10 shows an example of stock market data update system of the present invention. This system is identical to current art stock market data update system except for a TV signal interface (991) that can obtain data from TV signals. The system is

still connected to internet. Users still send their requests through Internet. The software programs used to display stock market information are the same as current art software programs. The only difference is that there is a parallel data path from the stock information provider to all users through TV data transfer methods of the present invention. In a prior art system, the most updated stock prices are sent to millions of users through Internet. That means millions of duplicated copies are sent to individual users. Using the TV data transfer methods of the present invention, the stock information providers only need to send out one copy of the latest stock data. Updating latest stock price only requires a few thousand bits per second. Any one data transfer method of the present invention will easily handle the bandwidth requirement, while all the users can obtain real-time stock prices simultaneously with minimum delay. Note that the system does not have to use a computer. A video game controller described in FIG. 9(a) can be programmed to have stock update capability.

Data transfer system of the present invention uses existing TV broadcast systems to send data. It will satisfy the bandwidth requirement for many applications without any changes to existing system. The system requires little resource to implement. It is the most cost efficient method to solve the bandwidth problem, and the system can be established in a short time.

The most important limitation for these data transfer system is that they are one-way broadcast system. The transmission path tends to be noisy. It is therefore necessary to implement data quality control methods such as parity check, check sum, error correction code, Hemming code, ... etc. Those methods to assure data quality for a noisy media are well-known to the art. There is no need to describe them in details. Another important issue is security. Security measured to protect broadcast data should be implemented for data with security concerns.

Although the present invention has been described in terms of the presently preferred embodiment, it is to be understood that such disclosure is not to be interpreted as limiting. Various alternations and modifications will no doubt become apparent to those skilled in the art after reading the above disclosure. Accordingly, it is intended that the appended claims be interpreted as covering all alternations and modifications as fall within the true spirit and scope of the invention.

[illegible]

CLAIMS

I claim:

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1. A data transfer method comprising steps of
- (a) examining a TV video signal, comprising electromagnetic (EM) waves distributed over time, for finding a time slot with a suitable EM wave transient rate;
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- (b) generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal in said time slot having said suitable EM waves transient rate; and
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- (c) transmitting said data-carrying TV signal to a TV and a data receiver.
2. The data transfer method of claim 1 wherein:
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- said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting a frequency-modulated (FM) data signal into said time slot having said suitable EM wave transient rate.
- 25
3. The data transfer method of claim 1 wherein:
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- said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting multiple frequency-modulated (MF) data signals into said time slot having said suitable EM wave transient rate.

- said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting a phase-modulated (PM) data signal into said time slot having said suitable EM wave transient rate.

- said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting a multiple-phase-modulated (MP) data signal into said time slot having said suitable EM wave transient rate.

- said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting a modulated data signal with a compensated format (CF) into said time slot having said suitable EM wave transient rate.

- said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting a compensated-amplitude (CA) modulated data signal into said time slot having said suitable EM wave transient rate.

8. The data transfer method of claim 1 wherein:

5 said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting a differential amplitude (DA) modulated data signal into said time slot having said suitable EM wave transient rate.

9. The data transfer method of claim 1 wherein:

10 said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting said data signal into said time slot employed for black level data transfer (BLDT).

10. The data transfer method of claim 9 wherein:

15 said step of inserting said data signal into said time slots employed for black level data transfer (BLDT) comprising a step of inserting a frequency-modulated (FM) data signal into said time slot employed for BLDT.

11. The data transfer method of claim 9 wherein:

20 said step of inserting said data signal into said time slots employed for black level data transfer (BLDT) comprising a step of inserting a multiple-frequency-modulated (MF) data signal into said time slot employed for BLDT.

12. The data transfer method of claim 9 wherein:

25 said step of inserting said data signal into said time slots employed for black level data transfer (BLDT) comprising a step of inserting a phase-modulated (PF) data signal into said time slot employed for BLDT.

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- said step of inserting said data signal into said time slots employed for black level data transfer (BLDT) comprising a step of inserting a differential amplitude (DA)-modulated data signal into said time slot employed for BLDT.

17. The data transfer method of claim 1 wherein:

5 said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting said data signal into said time slot employed for white level data transfer (WLDT).

18. The data transfer method of claim 17 wherein:

10 said step of inserting said data signal into said time slots employed for white level data transfer (WLDT) comprising a step of inserting a frequency-modulated (FM) data signal into said time slot employed for WLDT.

19. The data transfer method of claim 17 wherein:

15 said step of inserting said data signal into said time slots employed for white level data transfer (WLDT) comprising a step of inserting a multiple-frequency-modulated (MF) data signal into said time slot employed for WLDT.

20. The data transfer method of claim 17 wherein:

25 said step of inserting said data signal into said time slots employed for white level data transfer (WLDT) comprising a step of inserting a phase-modulated (PF) data signal into said time slot employed for WLDT.

21. The data transfer method of claim 17 wherein:

30 said step of inserting said data signal into said time slots employed for white level data transfer (WLDT) comprising a step of inserting a multiple-phase-modulated (MP) data signal into said time slot employed for WLDT.

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22. The data transfer method of claim 17 wherein:

5 said step of inserting said data signal into said time slots employed for white level data transfer (WLDT) comprising a step of inserting a modulated signal with compensated-format (CF) as data signal into said time slot employed for WLDT.

23. The data transfer method of claim 17 wherein:

10 said step of inserting said data signal into said time slots employed for white level data transfer (WLDT) comprising a step of inserting a compensated amplitude (CA) modulated data signal into said time slot employed for WLDT.

24. The data transfer method of claim 17 wherein:

15 said step of inserting said data signal into said time slots employed for white level data transfer (WLDT) comprising a step of inserting a differential amplitude (DA)-modulated data signal into said time slot employed for WLDT.

25. The data transfer method of claim 1 wherein:

20 said step (b) of generating a data-carrying TV signal by inserting into said TV signal a hidden-from-viewer data signal comprising a step of inserting said data signal into said time slot employed for blank level data transfer (KLDT).

26. The data transfer method of claim 25 wherein:

30 said step of inserting said data signal into said time slots employed for blank level data transfer (KLDT) comprising a step of inserting a frequency-modulated (FM) data signal into said time slot employed for KLDT.

26. The data transfer method of claim 25 wherein:
- said step of inserting said data signal into said time slots employed for blank level data transfer (KLDT) comprising a step of inserting a multiple-frequency-modulated (MF) data signal into said time slot employed for KLDT.
27. The data transfer method of claim 25 wherein:
- said step of inserting said data signal into said time slots employed for blank level data transfer (KLDT) comprising a step of inserting a phase-modulated (PF) data signal into said time slot employed for KLDT.
28. The data transfer method of claim 25 wherein:
- said step of inserting said data signal into said time slots employed for blank level data transfer (KLDT) comprising a step of inserting a multiple-phase-modulated (MP) data signal into said time slot employed for KLDT.
29. The data transfer method of claim 25 wherein:
- said step of inserting said data signal into said time slots employed for blank level data transfer (KLDT) comprising a step of inserting a modulated signal with compensated-format (CF) as data signal into said time slot employed for KLDT.
30. The data transfer method of claim 25 wherein:
- said step of inserting said data signal into said time slots employed for blank level data transfer (KLDT) comprising a step of inserting a compensated amplitude (CA) modulated data signal into said time slot employed for KLDT.

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said step (a) of rearranging said TV signal into said non-viewer-interfering data-carrying TV signal comprising a step of arranging said TV signal according to a color table data transfer (CTDT) method by best fitting a TV pixel signal to a color in one of at least two color tables for representing a binary level of a data according to a color table employed for encoding said binary level of said data into said TV pixel signal.

said step (a) of rearranging said TV signal into said non-viewer-interfering data-carrying TV signal comprising a step of arranging said TV signal according to a predefined object data transfer (PODT) method by prearranging a TV pixel signal for showing a designated object and employing said TV pixel signal for transmitting a data signal.

36. The data transfer method of claim 33 wherein:

said step (a) of rearranging said TV signal into said non-viewer-interfering data-carrying TV signal comprising a step of arranging said TV signal according to a small object data transfer (SODT) method by detecting a TV pixel signal for showing a small object and employing said TV pixel signal for transmitting a data signal.

37. The data transfer method of claim 33 wherein:

said step (a) of rearranging said TV signal into said non-viewer-interfering data-carrying TV signal comprising a step of arranging said TV signal according to a dedicated object data transfer (DODT) method by designating a TV pixel signal for showing a dedicated object and employing said TV pixel signal for transmitting a data signal.

38. The data transfer method of claim 33 wherein:

said step (a) of rearranging said TV signal into said non-viewer-interfering data-carrying TV signal comprising a step of arranging said TV signal according to an invisible frame data transfer (IFDT) method by determining a TV pixel signal in an invisible frame and employing said TV pixel signal for transmitting a data signal.

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said step (a) of employing said TV pixel signal in said invisible frame for transmitting a data signal comprising a step of transmitting a modulated data signal with a compensated format (CF).

44. The data transfer method of claim 38 wherein:

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said step (a) of employing said TV pixel signal in said invisible frame for transmitting a data signal comprising a step of transmitting a compensated-amplitude (CA) modulated data signal.

45. The data transfer method of claim 38 wherein:

10

said step (a) of employing said TV pixel signal in said invisible frame for transmitting a data signal comprising a step of transmitting a differential amplitude (DA) modulated data signal.

15

46. A video game system comprising:

a TV signal interface/decoding means for receiving a TV signal encoded with a video-game data-signal therein for decoding and employing said data signal.

20

47. The video game system of claim 46 wherein:

said TV signal interface/decoding means comprising a TV interface means for receiving said TV signal encoded with said data-signal from a TV.

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48. The video game system of claim 46 further comprising:

a video game controller for allowing a video game player to control and play a video game on said video game system.

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Variable	Mean	Standard Deviation	Minimum	Maximum
Age	35.2	12.5	22	55
Gender	0.5	0.5	0	1
Marital Status	0.6	0.5	0	1
Education	12.5	2.5	9	16
Income	45000	15000	20000	80000
Health	0.8	0.2	0	1
Smoking	0.3	0.5	0	1
Alcohol	0.2	0.4	0	1
Exercise	0.4	0.5	0	1
Stress	0.6	0.5	0	1
Depression	0.1	0.3	0	1
Loneliness	0.3	0.4	0	1
Life Satisfaction	0.7	0.3	0	1
Quality of Life	0.8	0.2	0	1
Overall Health	0.9	0.1	0	1
Physical Health	0.9	0.1	0	1
Mental Health	0.8	0.2	0	1
Social Health	0.7	0.3	0	1
Emotional Health	0.6	0.4	0	1
Behavioral Health	0.5	0.5	0	1
Environmental Health	0.4	0.6	0	1
Occupational Health	0.3	0.7	0	1
Financial Health	0.2	0.8	0	1
Family Health	0.1	0.9	0	1
Community Health	0.0	1.0	0	1

- a TV signal interface/decoding means for receiving a TV signal encoded with a data-signal comprising stock price data.

ABSTRACT

5 Data transfer system of the present invention examines TV video
signal for unused bandwidth. Data signals are inserted into TV video
signal when unused bandwidth is found. The resulting video signal is
still used for TV display without sacrificing video quality. These data
transfer methods provide an alternative high-bandwidth data path to
10 Internet. It will satisfy the bandwidth requirement for many applications
without any changes to existing system. The system requires little
resource to implement. It is the most cost efficient method to solve the
bandwidth problem, and the system can be established in a short time.

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FIG.1(a) prior art

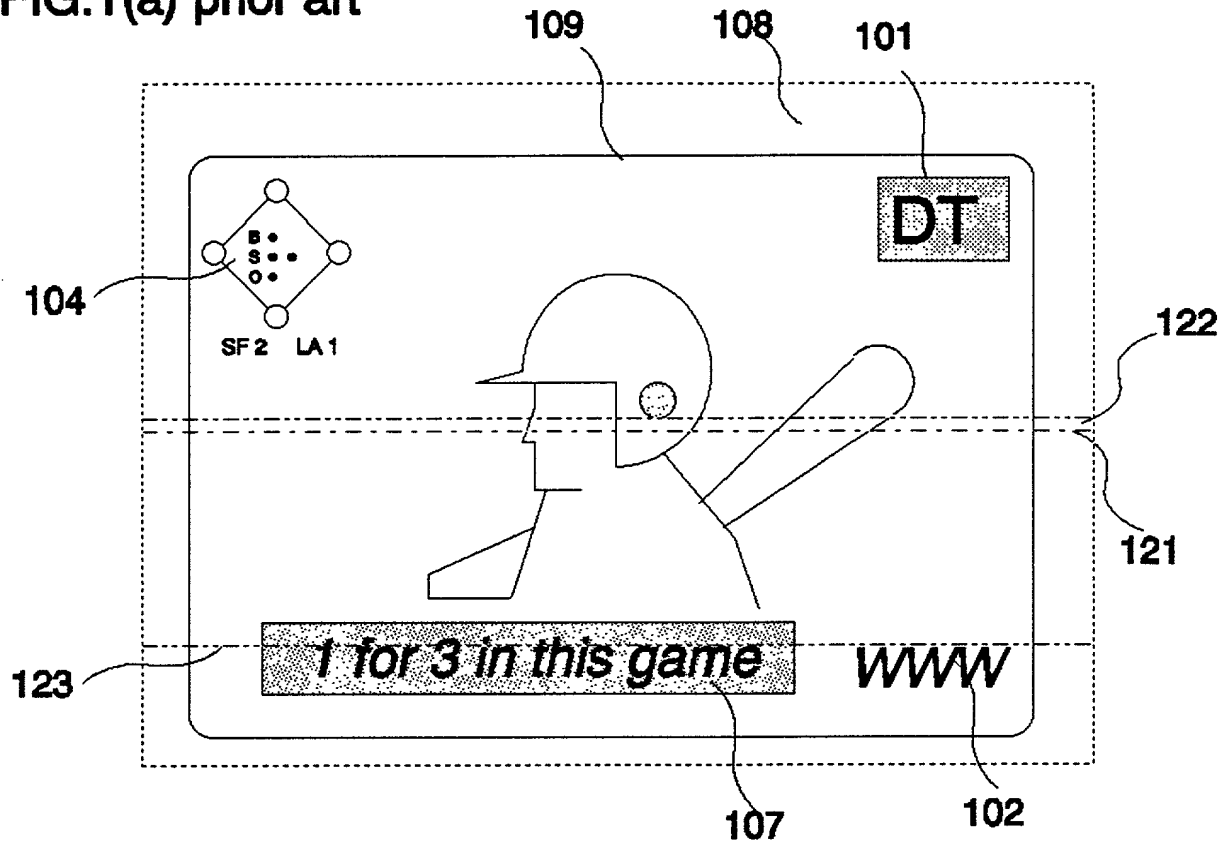


FIG.1(b) prior art

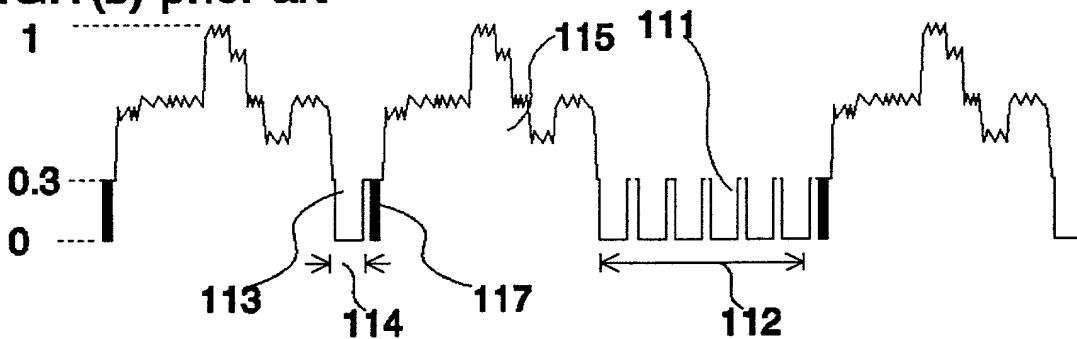


FIG.1(c) prior art

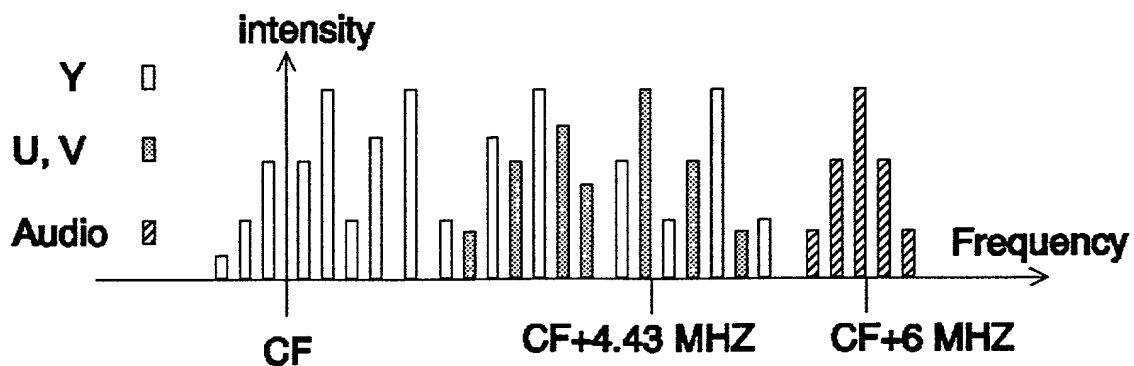


FIG.1(d) prior art

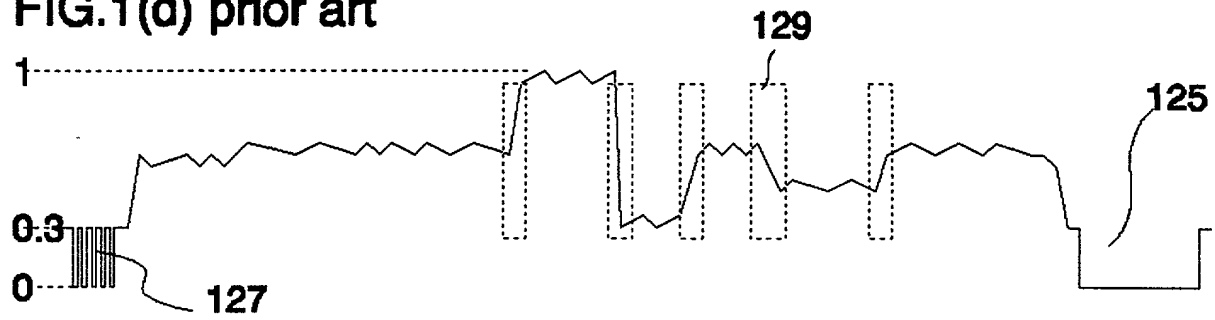


FIG.1(e) prior art

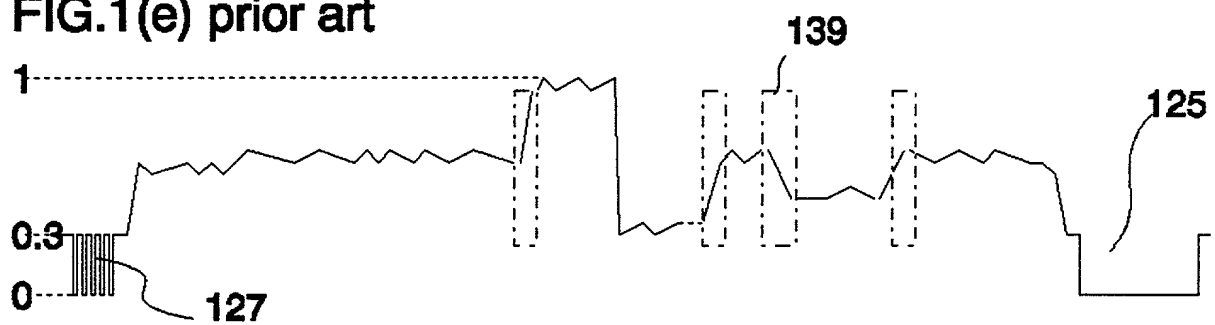


FIG.1(f) prior art

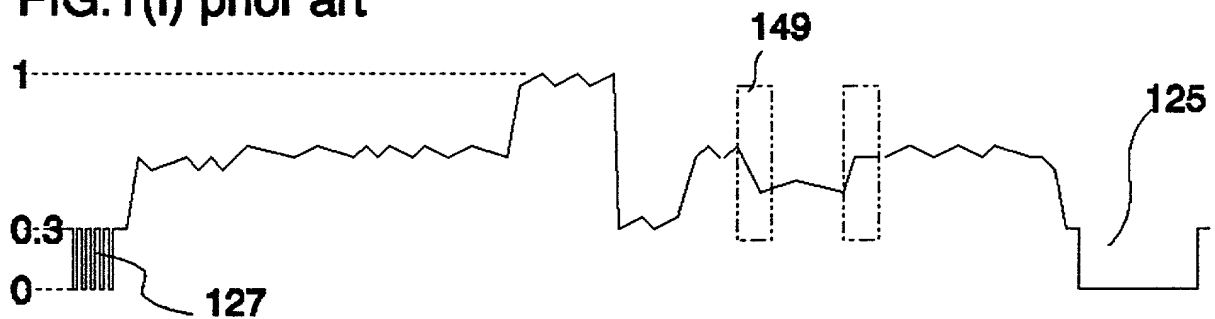
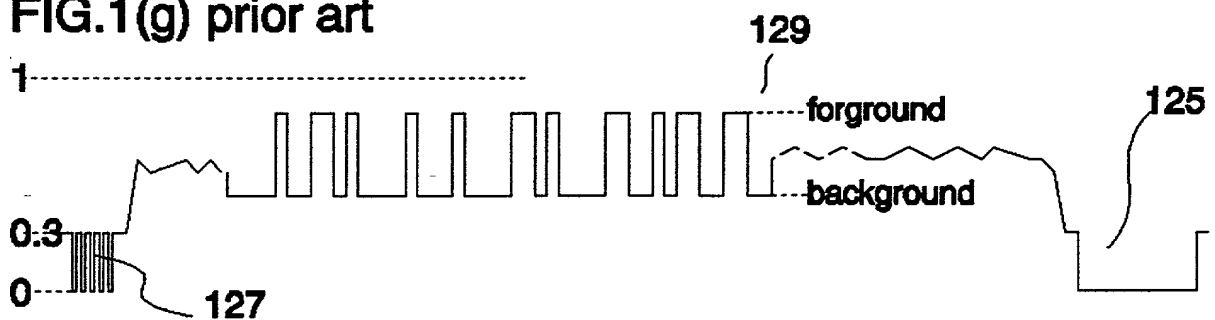


FIG.1(g) prior art



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
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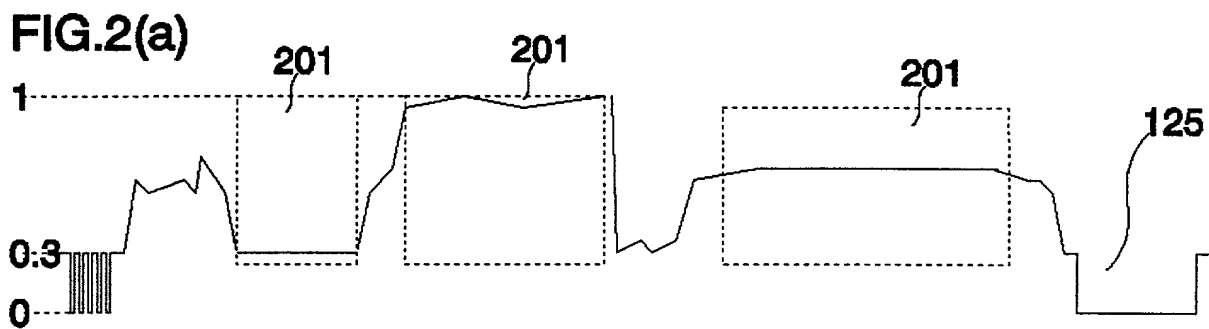


FIG. 2(b)

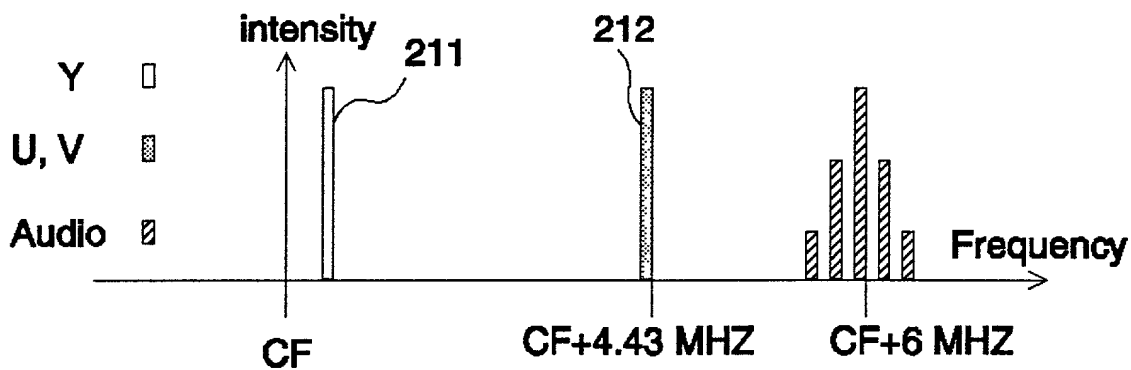


FIG. 2(c)

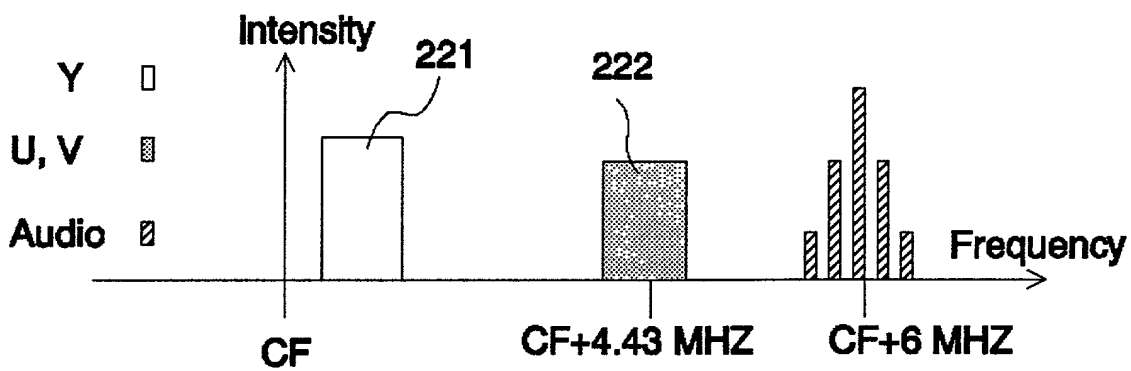


FIG. 2(d)

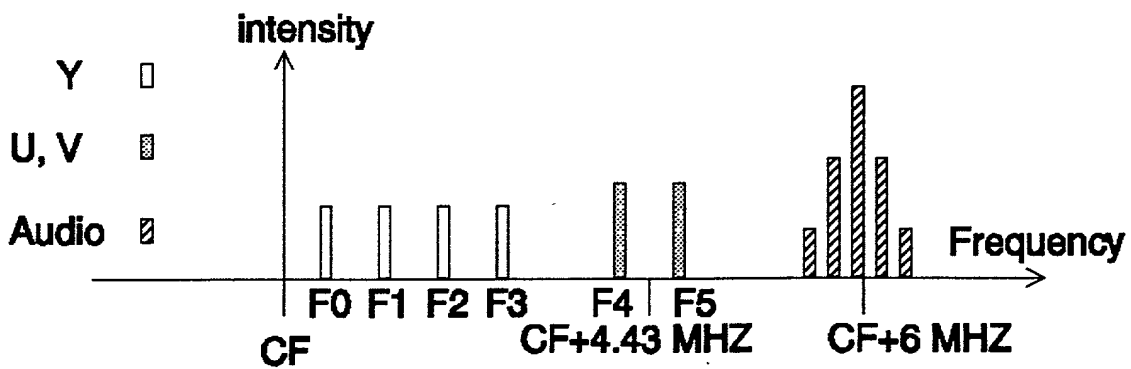


FIG.2(e)

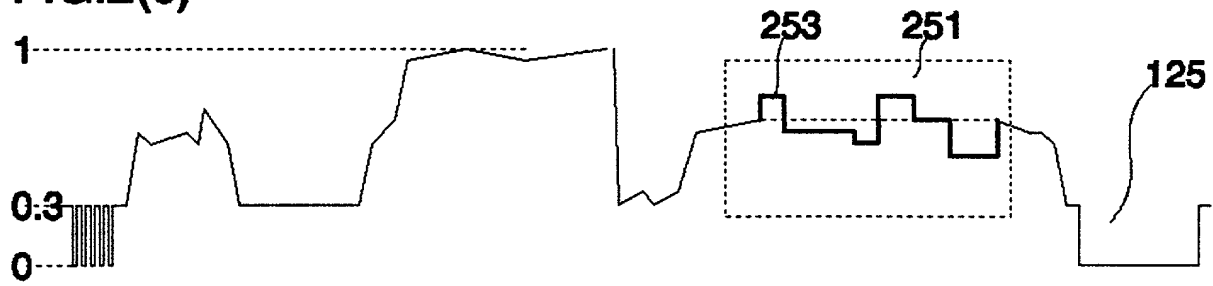


FIG.2(f)

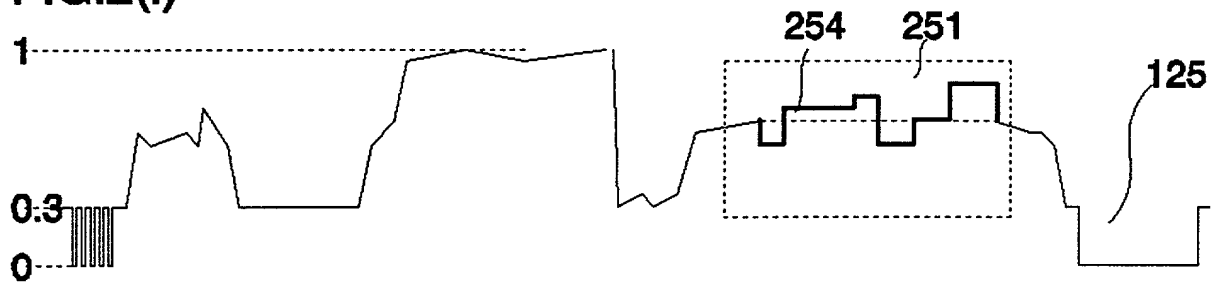


FIG.2(g)

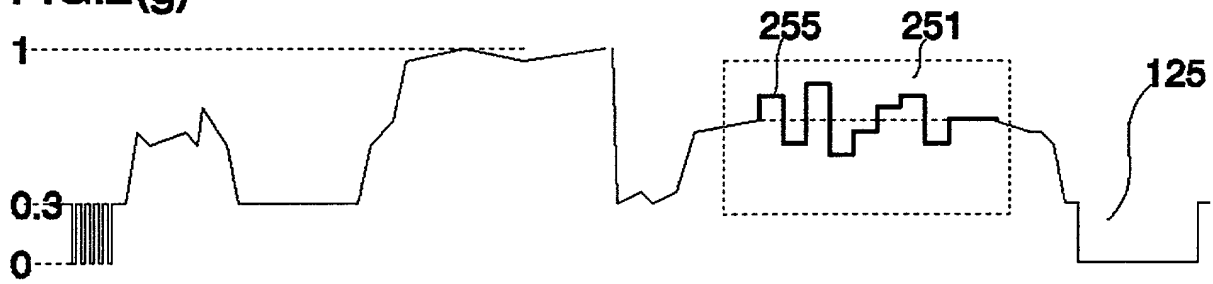


FIG.2(h)

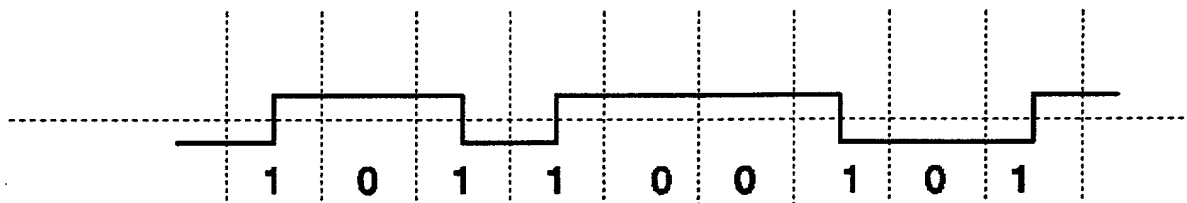


FIG.3(a)

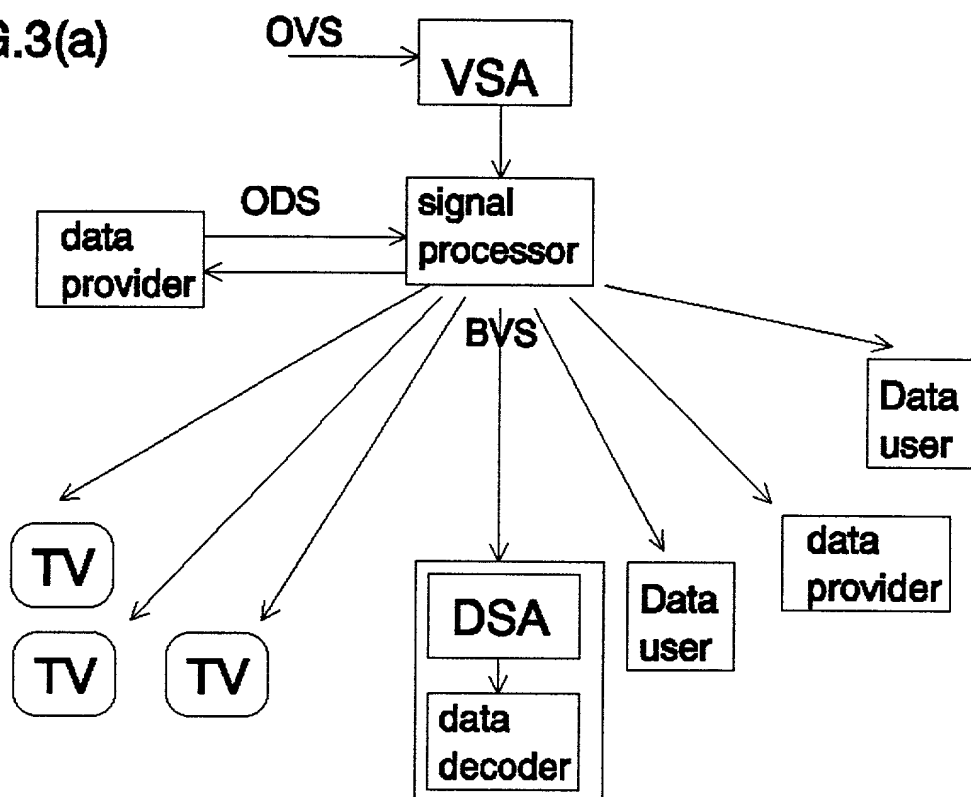


FIG.3(b)

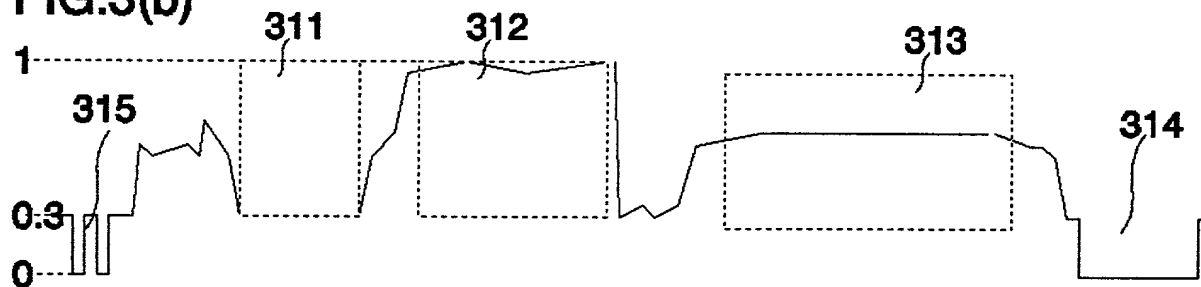


FIG.3(c)



FIG.3(d)

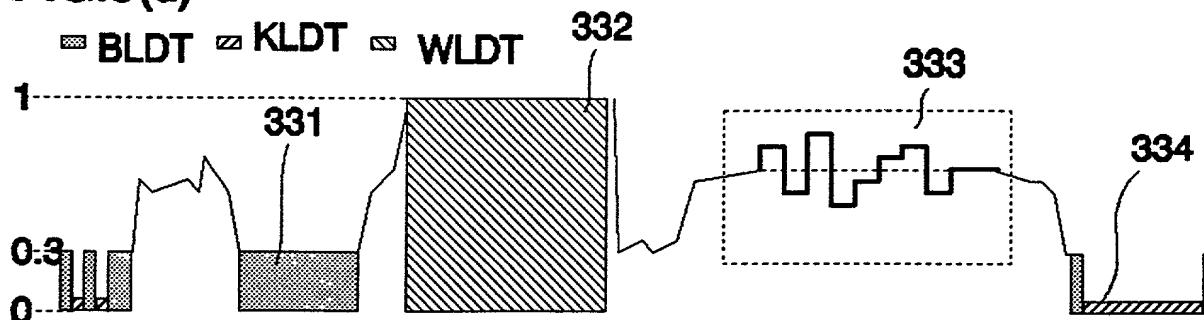


FIG.4(a)

FIG.4(b)

FIG.4(c)

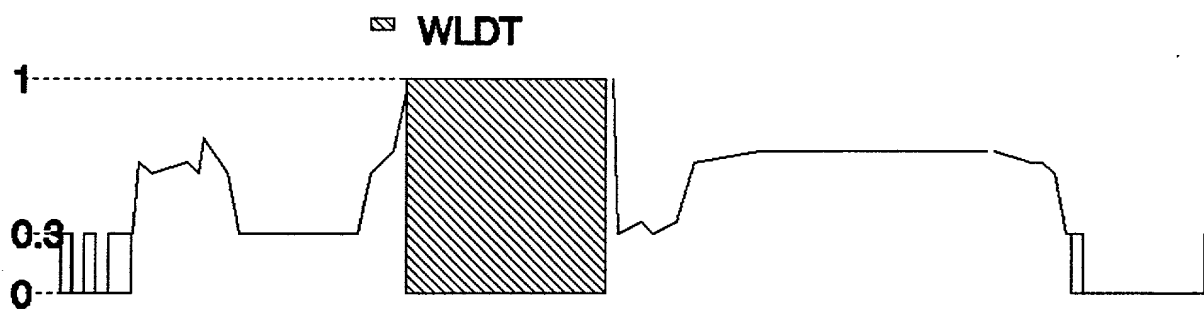
[illegible]

FIG.6(a)



FIG.6(b)

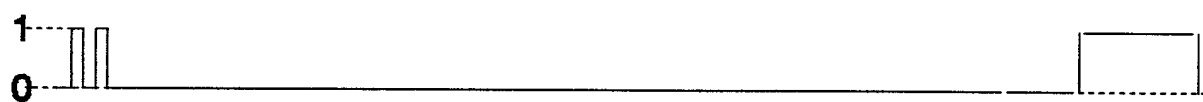


FIG.6(c)

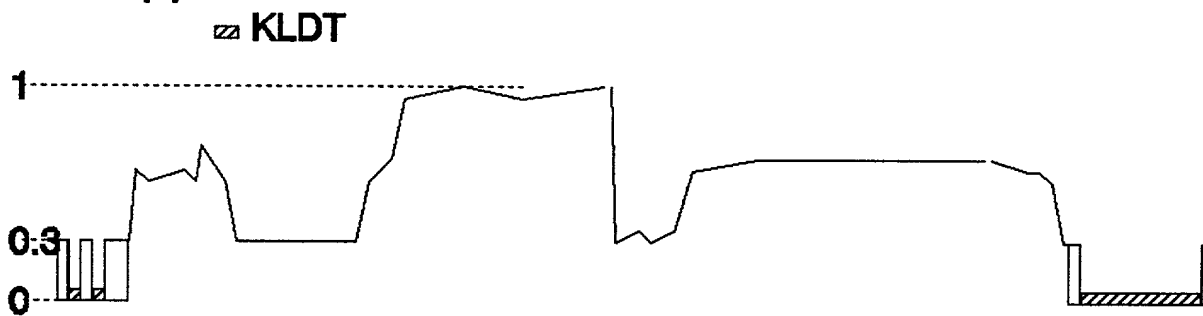


FIG. 7(a)

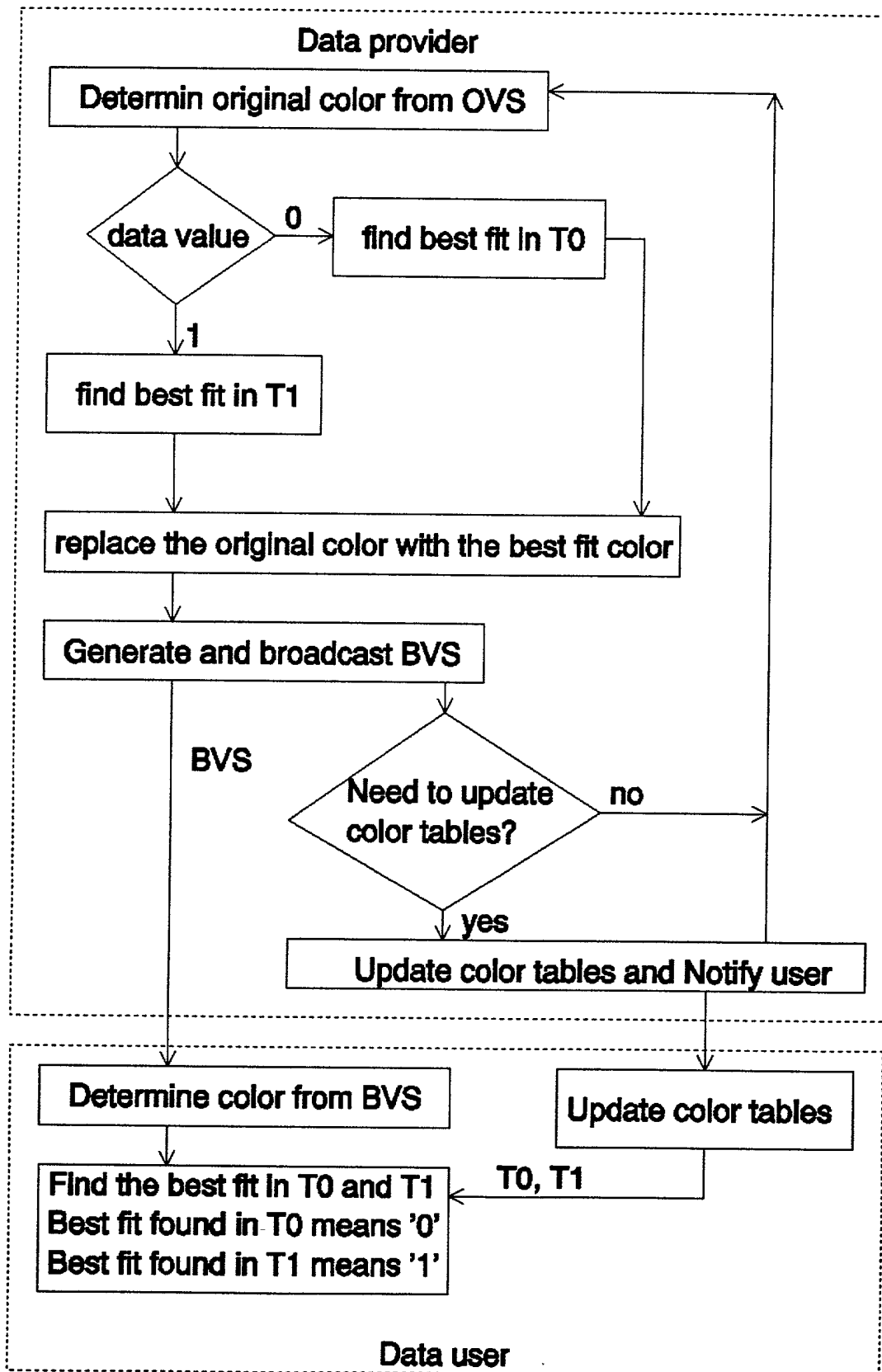


FIG. 7(b)

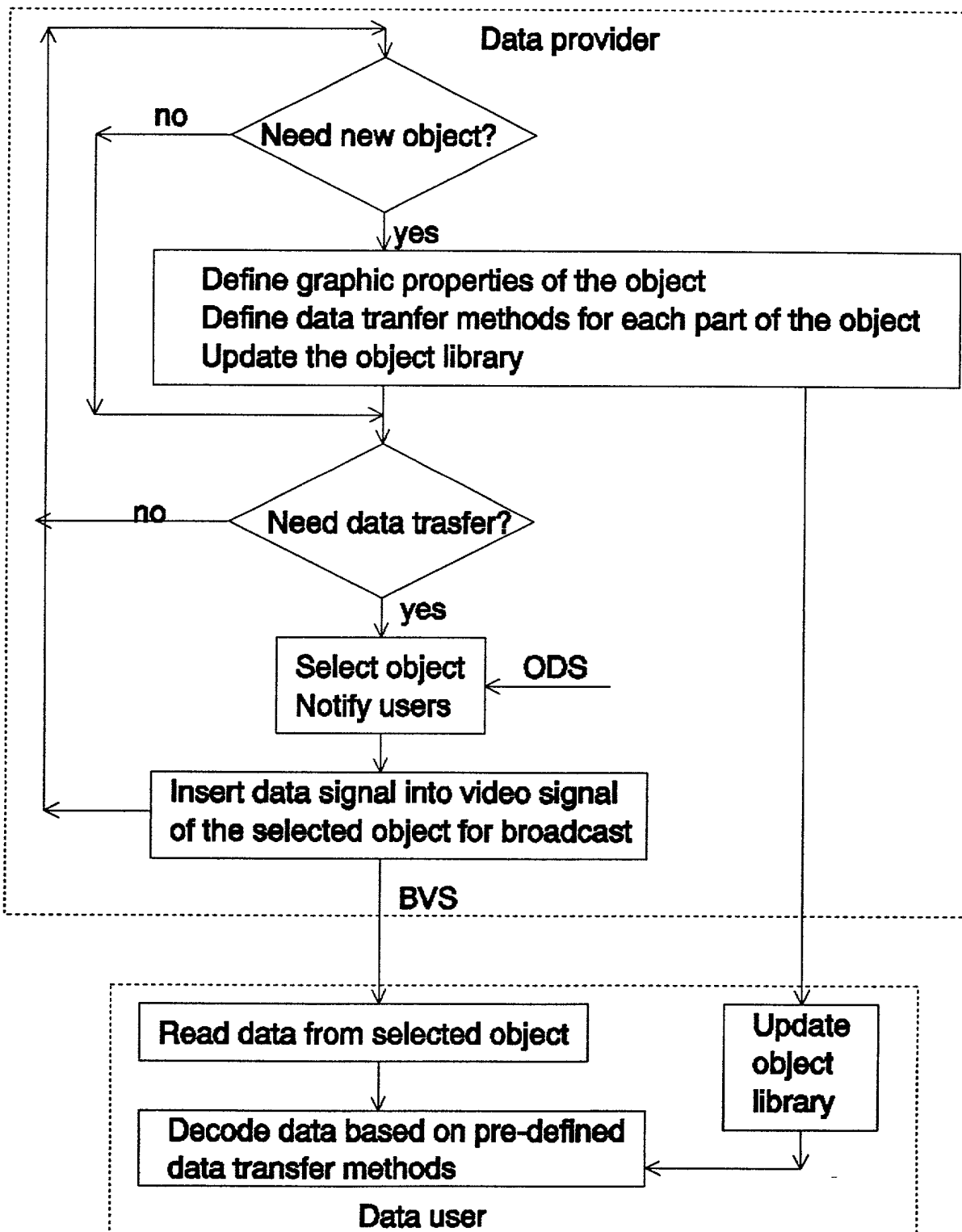


FIG. 7(c)

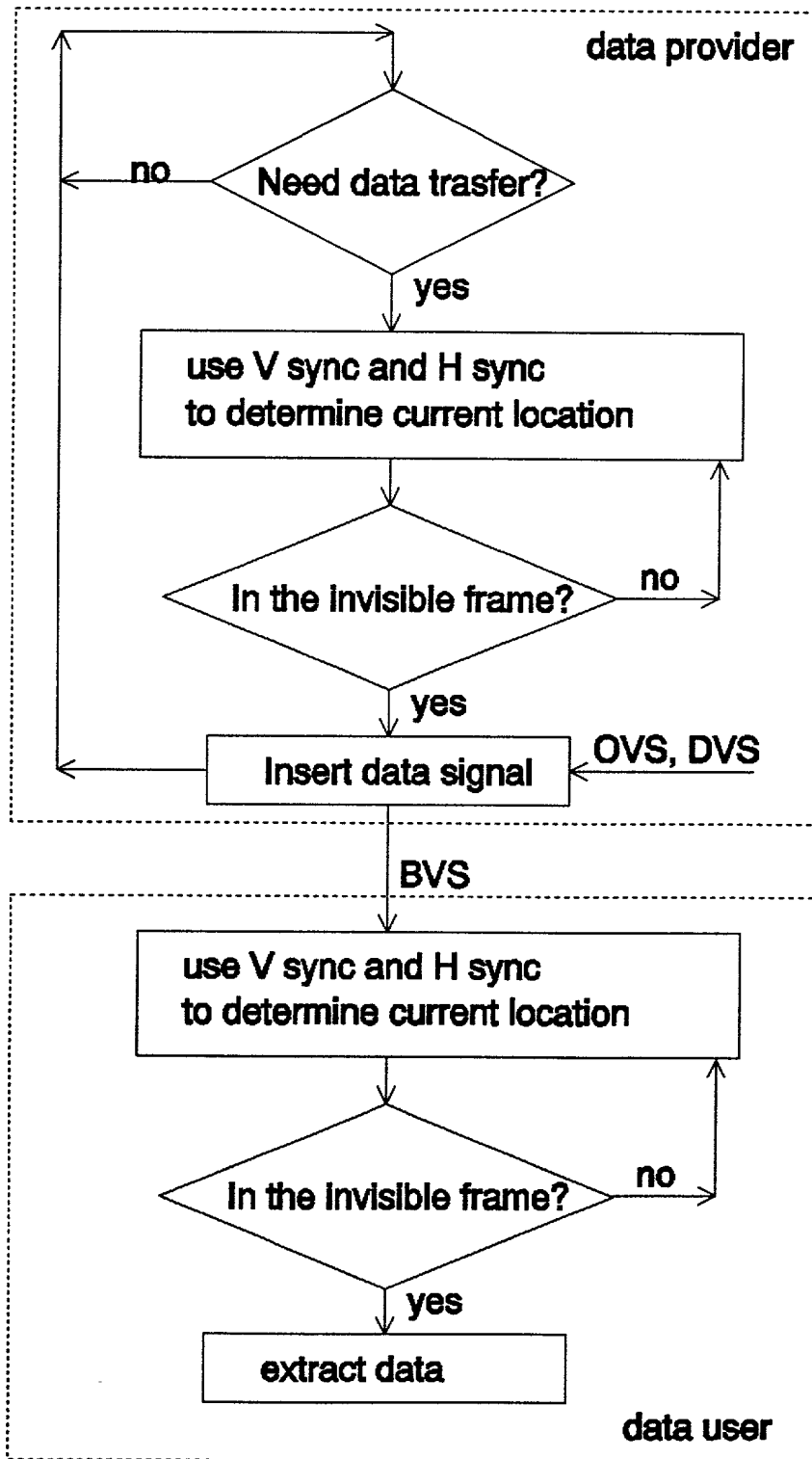


FIG. 8(a)

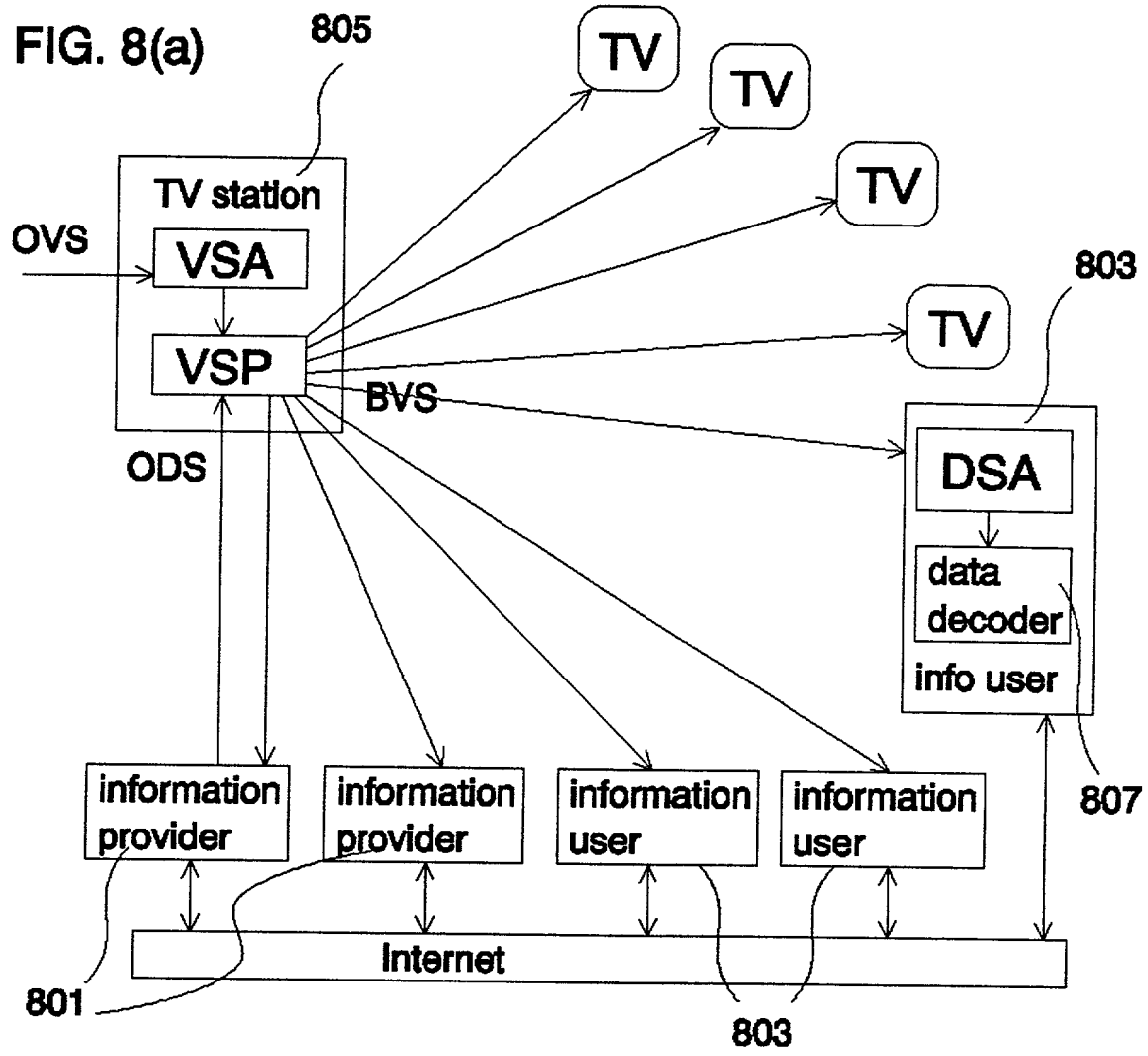


FIG. 9(a)

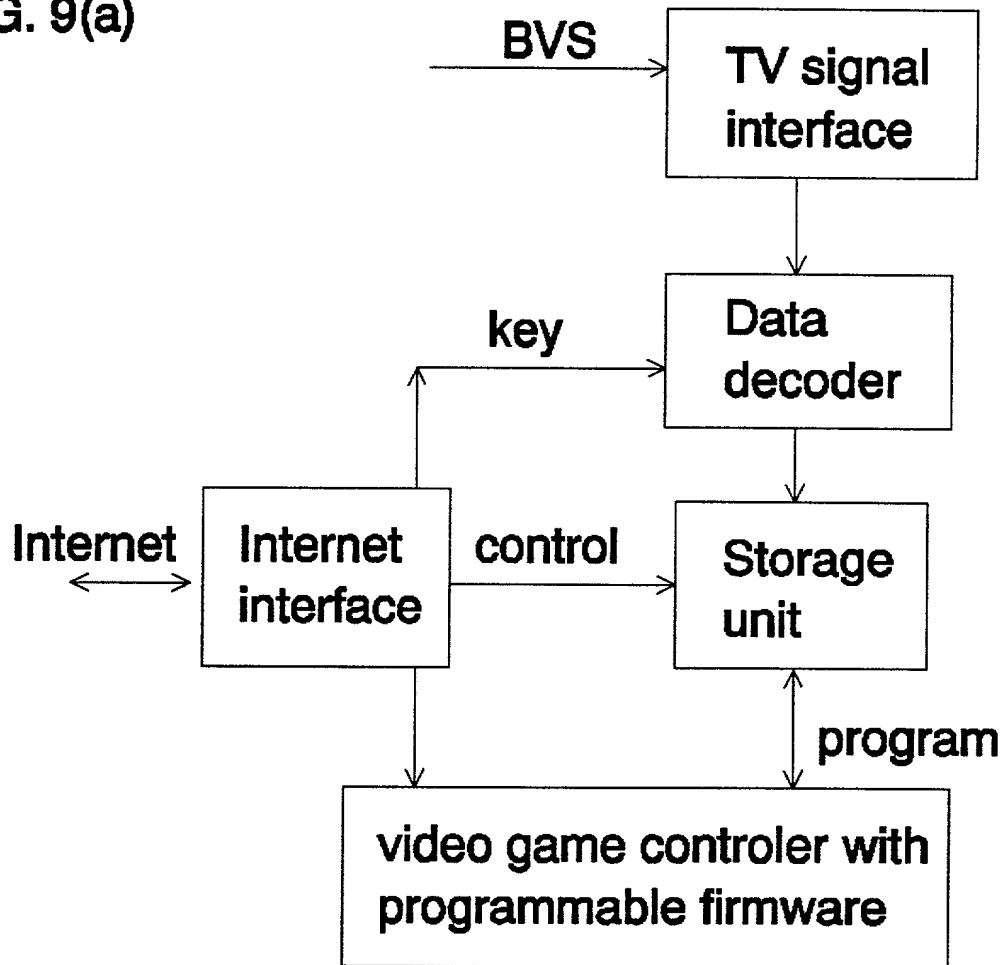


FIG. 9(b)

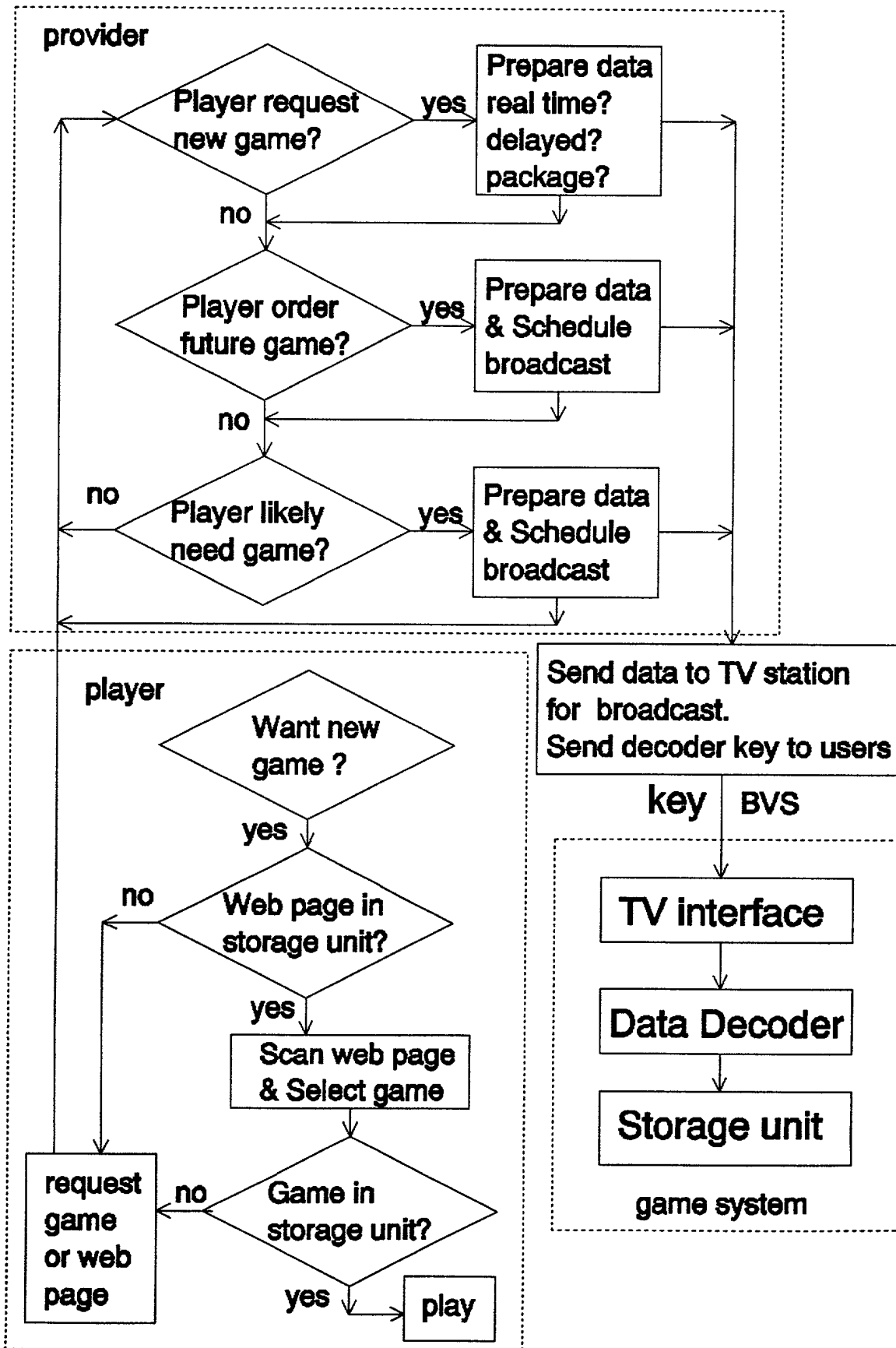
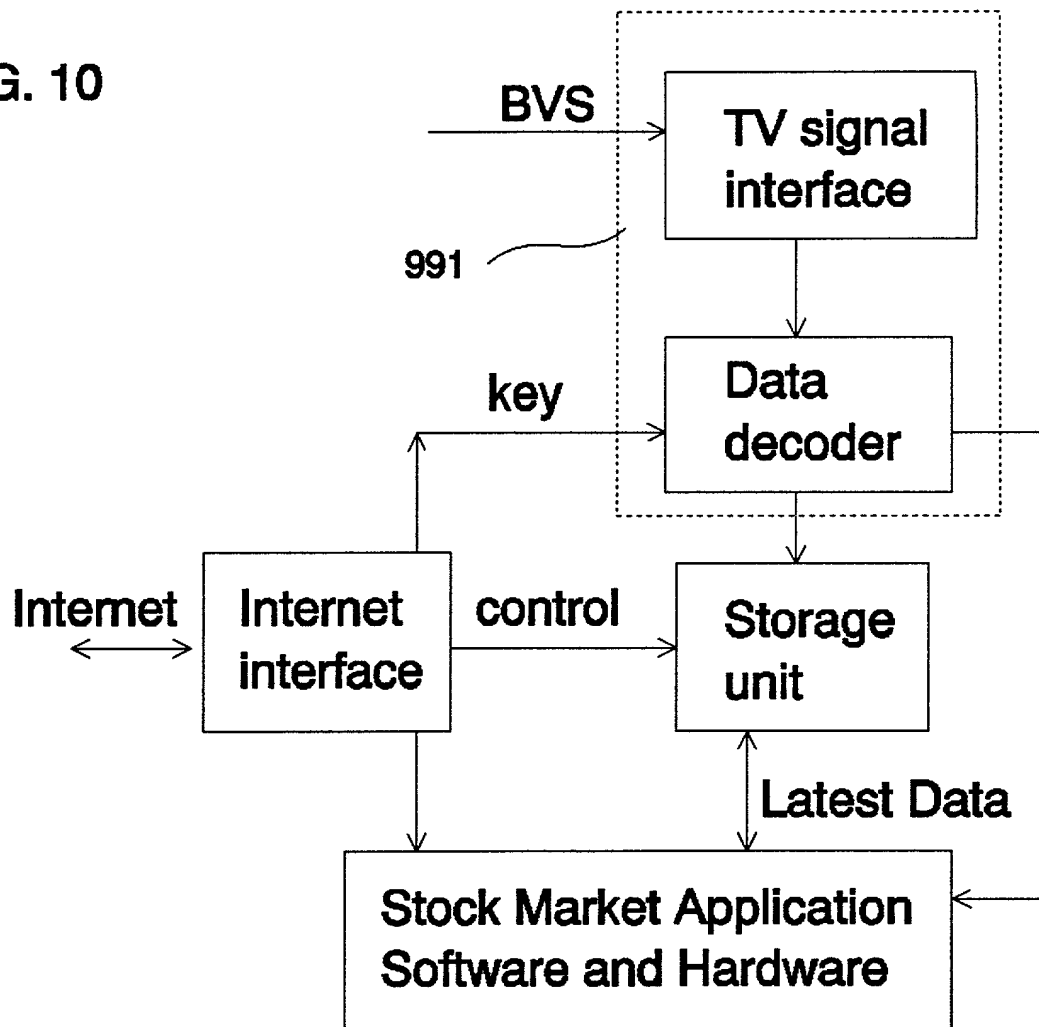


FIG. 10



Docket No. SHAU-2K01**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Title: DATA TRANSFER USING TELEVISION VIDEO SIGNAL

the specification of which (check one)

☒ is attached hereto.

_____ was filed on _____ as Application Serial No. _____ and was amended on _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s) Priority Claimed

_____ Yes _____ No

(Number)

(Country)

(Day/Month/Year Filed)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)

(Filing Date)

(Status)(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Bo-In Lin(#33,948)

Send correspondence to:

13445 Mandoli Drive, Los Altos Hills, CA 94022Direct Telephone Calls to: (name and telephone number)Bo-In Lin, (650) 949-0418 (Tel) 949-4118(Fax)

DOCKET SHEET

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Inventor's signature:



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Inventor's signature:

Date:

Residence:

Citizenship:

Post office address:

Full name of third joint-inventor:

Inventor's signature:

Date:

Residence:

Citizenship:

Post office address:

Full name of fourth joint-inventor:

Inventor's signature:

Date:

Residence:

Citizenship:

Post office address:

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